THE American JOURNAL OF Surgery

OCTOBER 1954

THURSTON SCOTT WELTON, M.D., EDITOR

Longevity in Cancer

Trauma and Nephroptosis

Review of 250 Thyroid Operations

SIXTY-THIRD YEAR OF PUBLICATION

OCTOBER 1954

THE American JOURNAL OF Surgery

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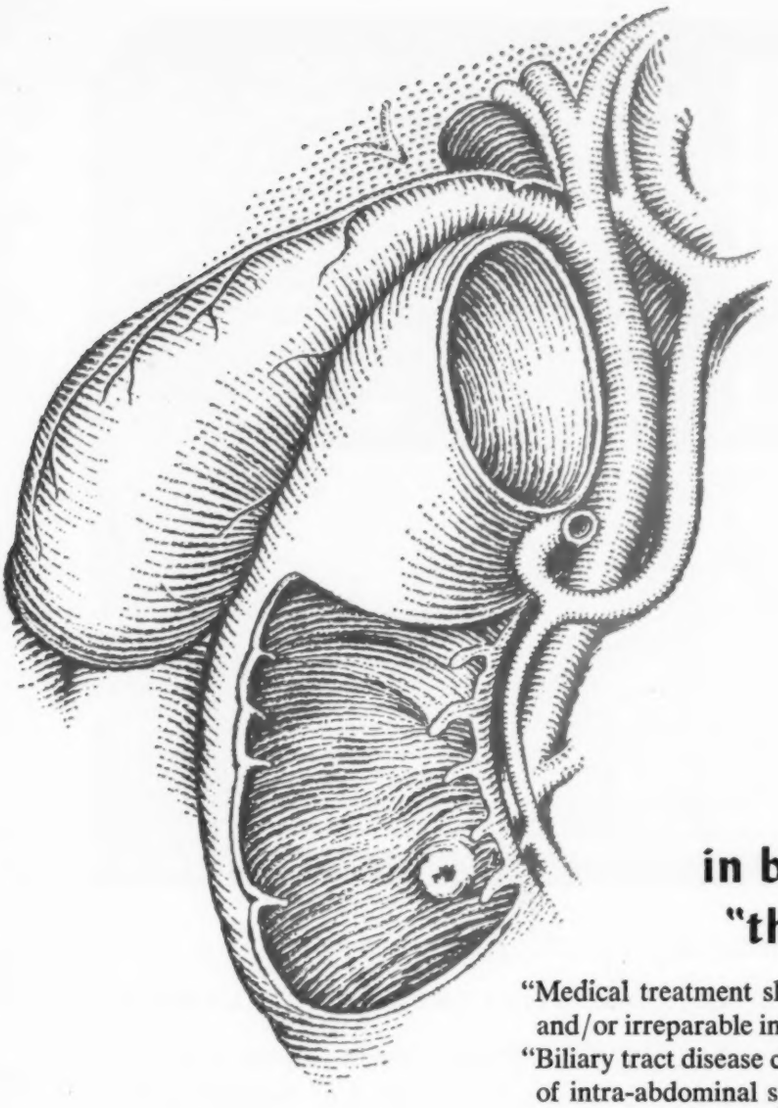

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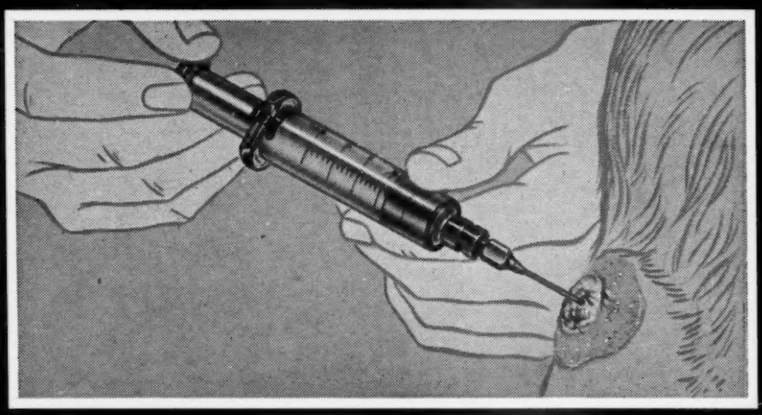

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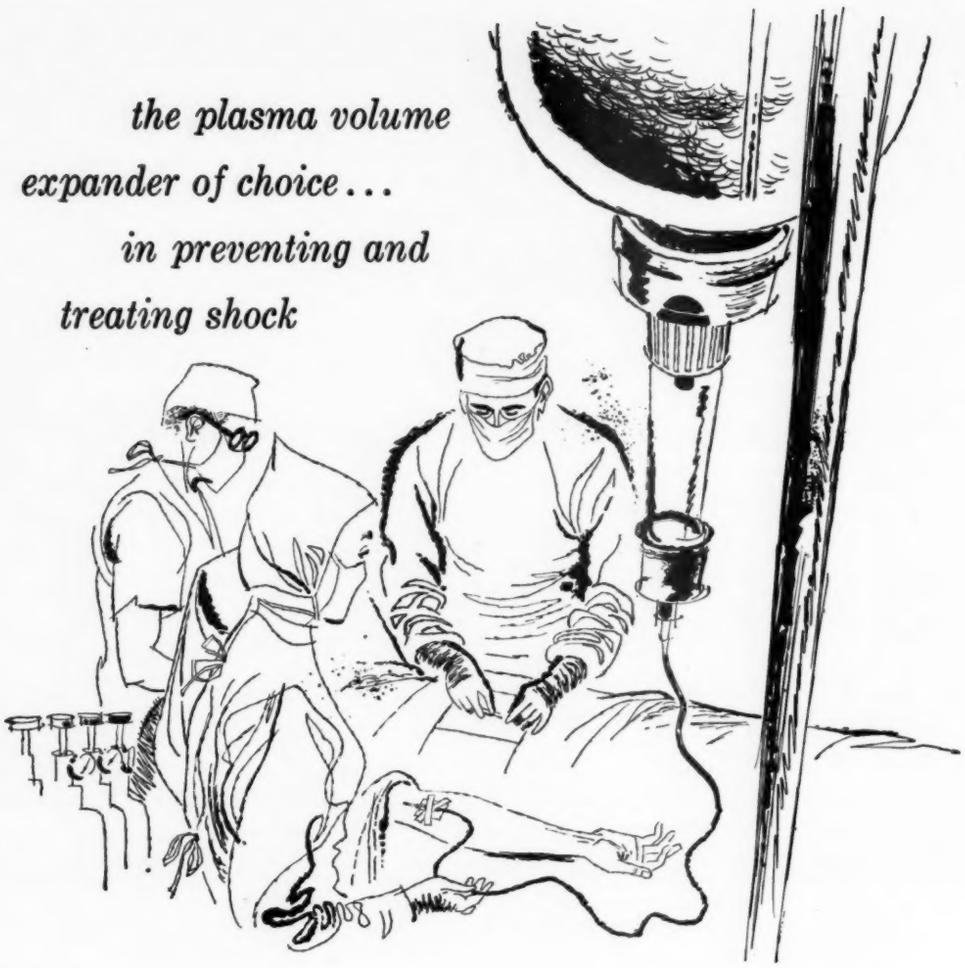

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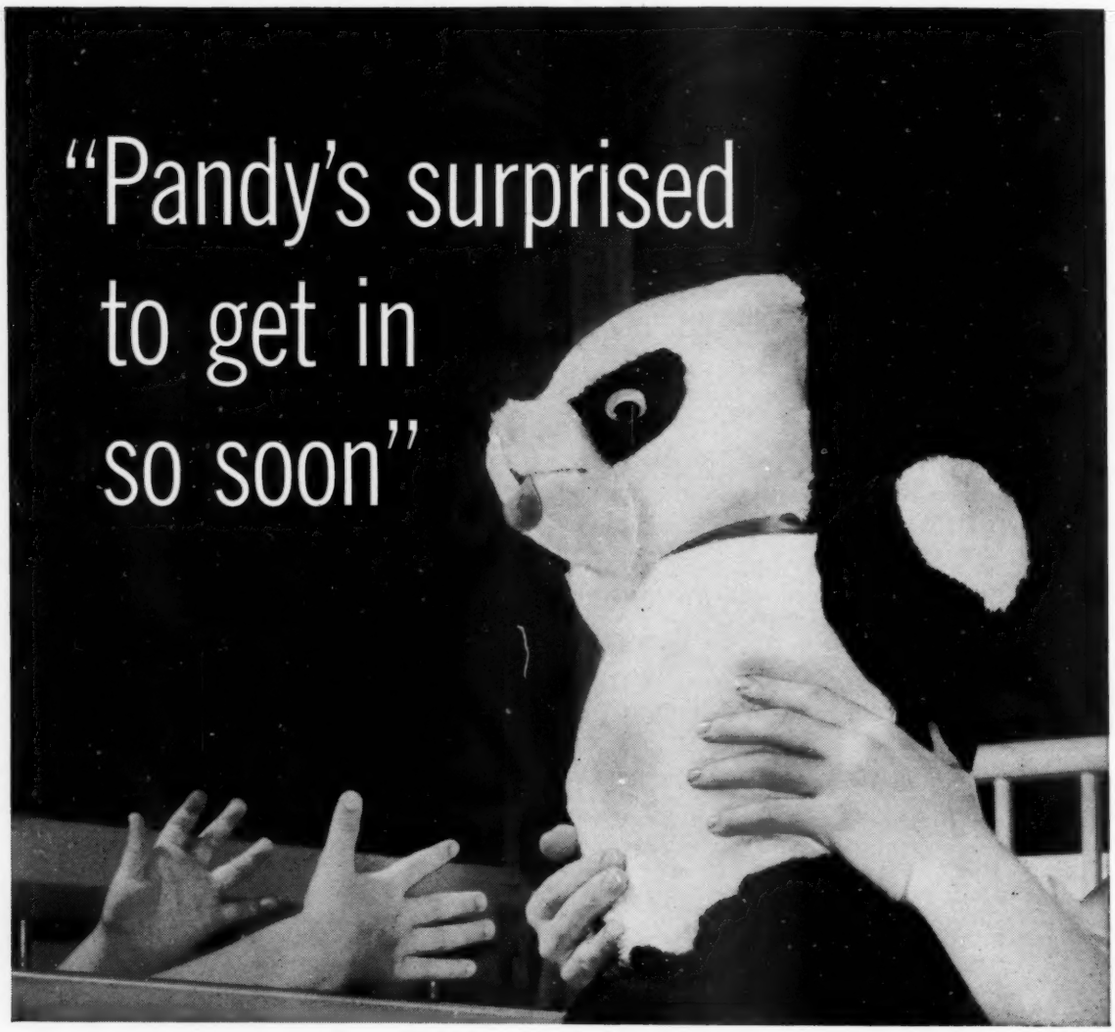

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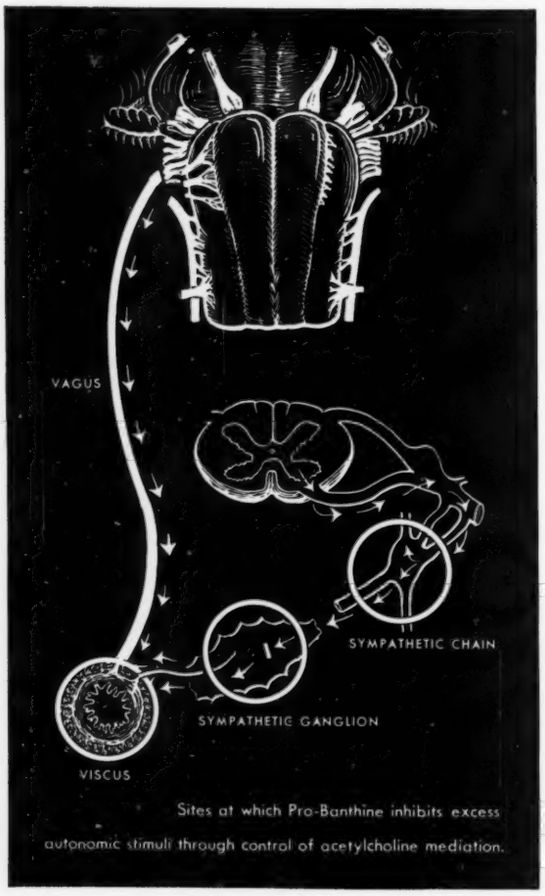

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1. Schwartz I. R.; Lehman, E.; Ostrove, R., and Seibel, J. M.: Gastroenterology *25*:416 (Nov.) 1953.

2. Roback, R. A., and Beal, J. M.: Gastroenterology *25*:24 (Sept.) 1953.

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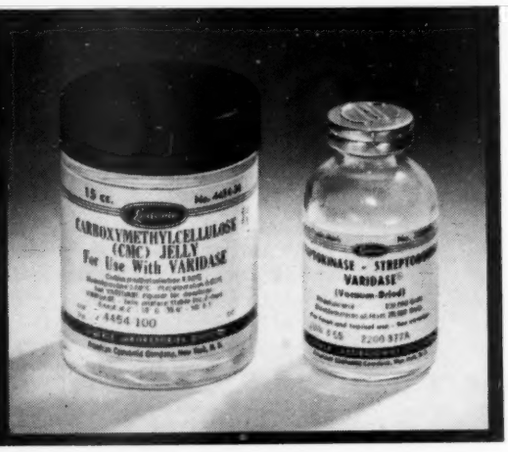

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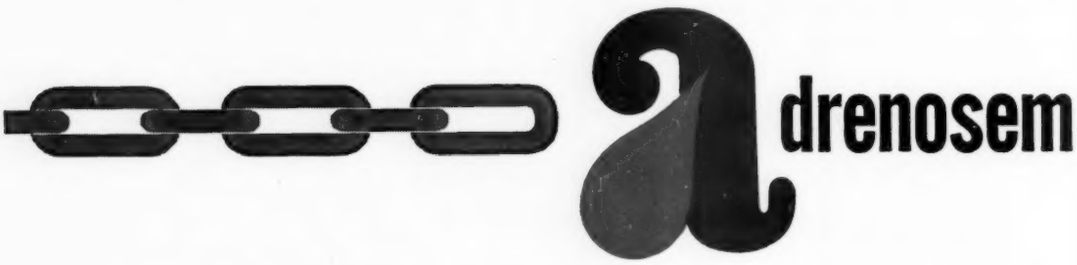

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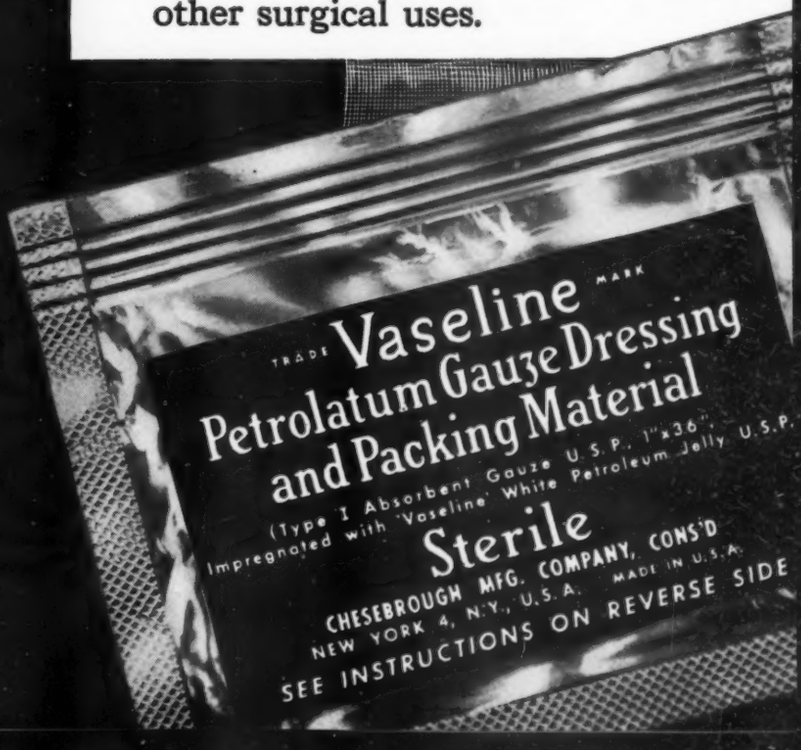
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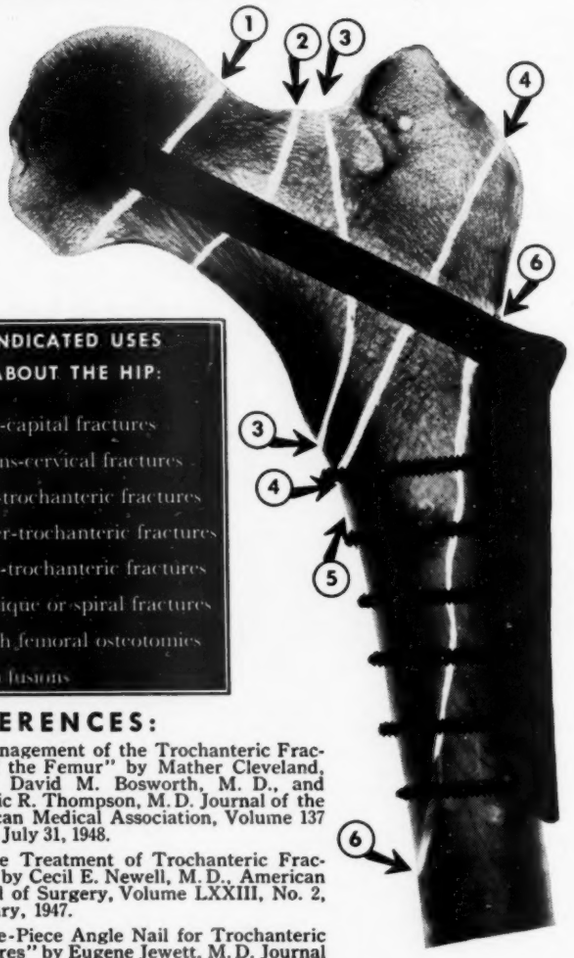

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REFERENCES:

* 1. "Management of the Trochanteric Fracture of the Femur" by Mather Cleveland, M. D., David M. Bosworth, M. D., and Frederic R. Thompson, M. D. Journal of the American Medical Association, Volume 137 No. 14, July 31, 1948.

2. "The Treatment of Trochanteric Fractures" by Cecil E. Newell, M. D., American Journal of Surgery, Volume LXXIII, No. 2, February, 1947.

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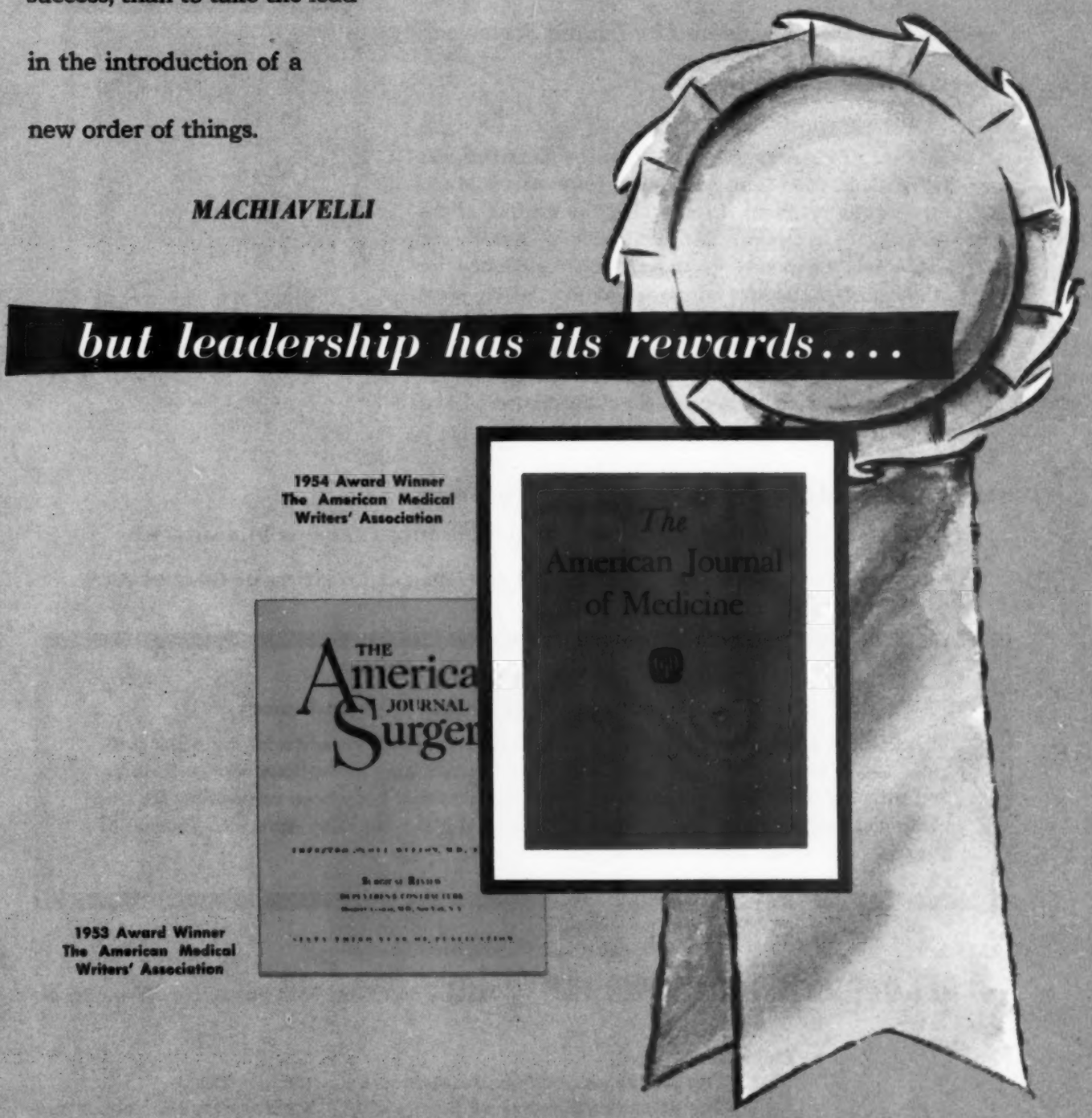

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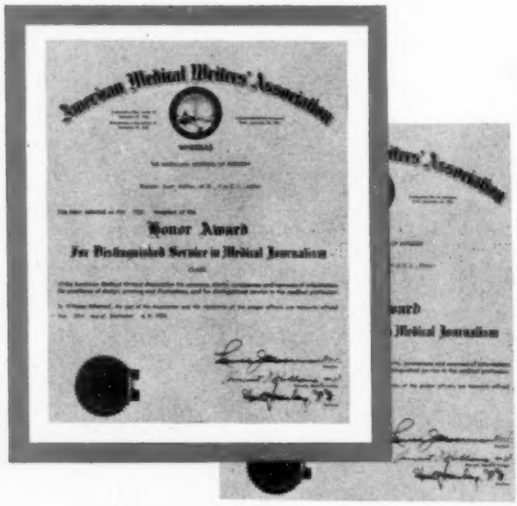

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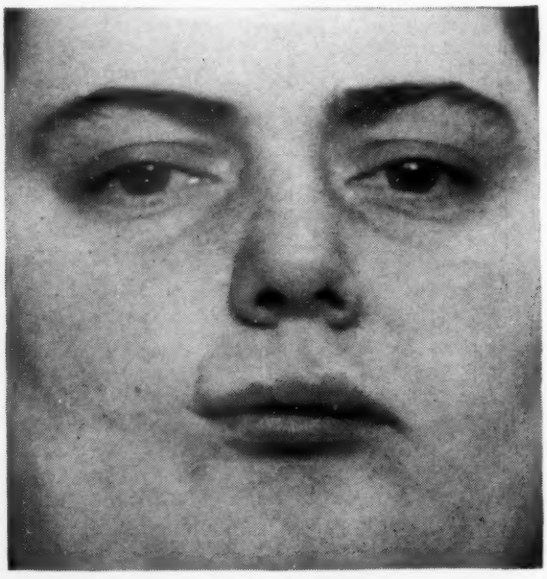
*Straith, C. L., and Straith, R. E.: Detroit, Michigan. Postgrad. Med. *14*:165, Sept., 1953.



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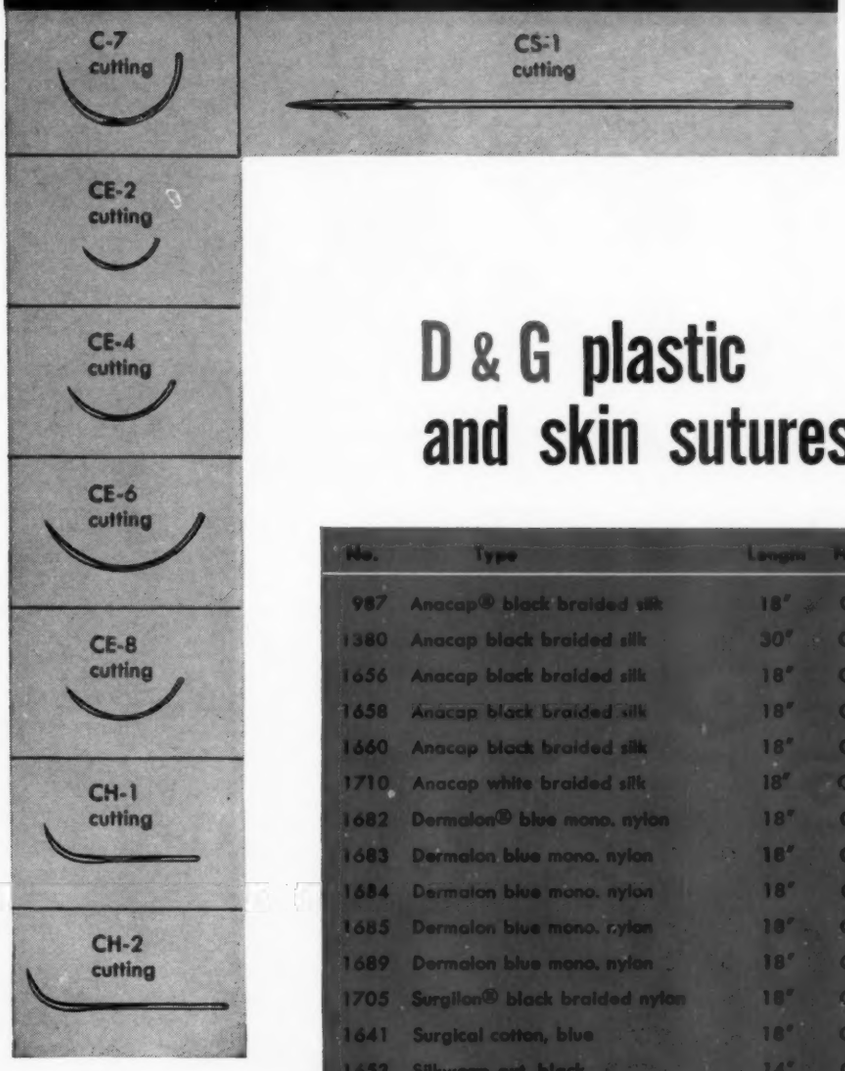

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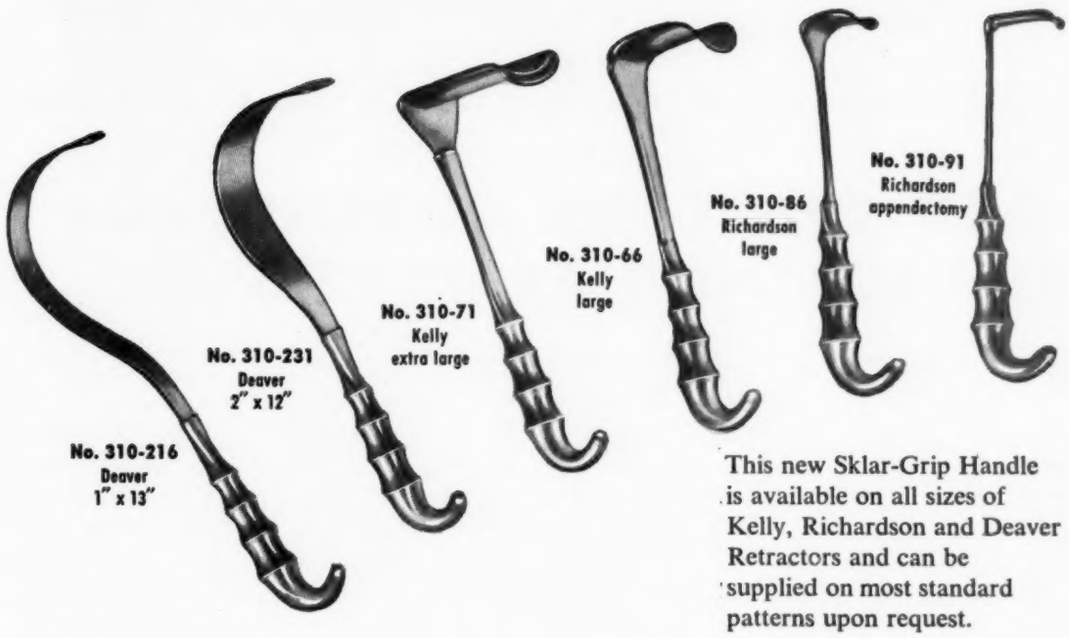

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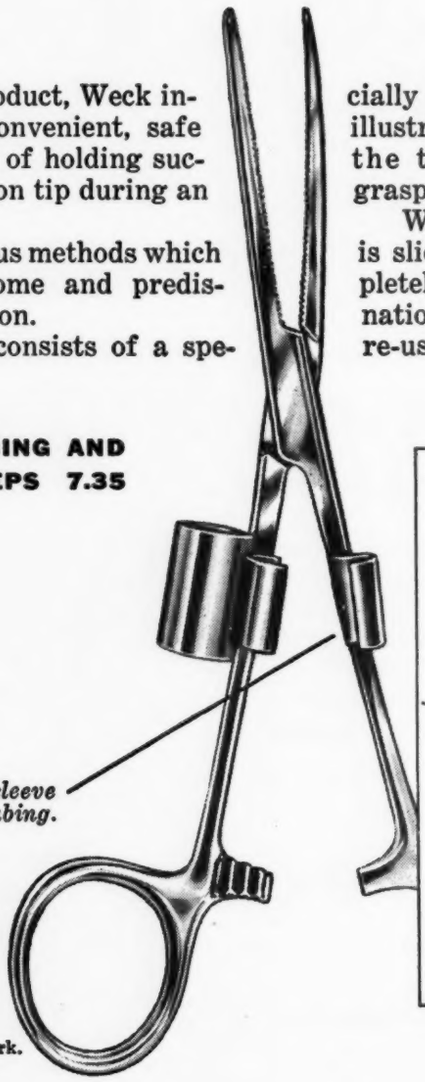
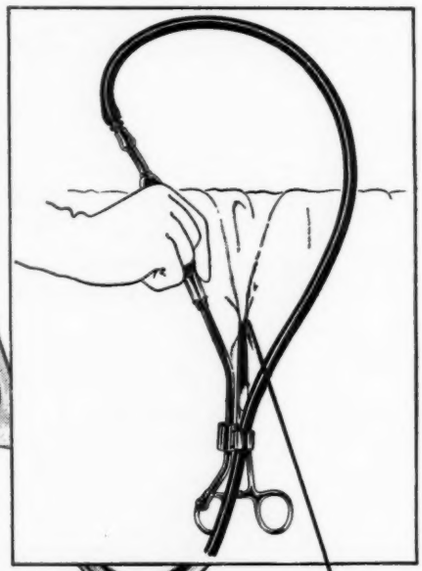


Note divided sleeve ready to grip tubing.



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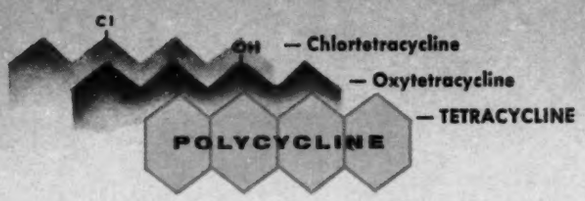

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* Choy, D. S. J.: Clinical trials of a new plastic dressing for burns and surgical wounds. A.M.A. Arch. Surg. 68:33-43 (Jan.) 1954

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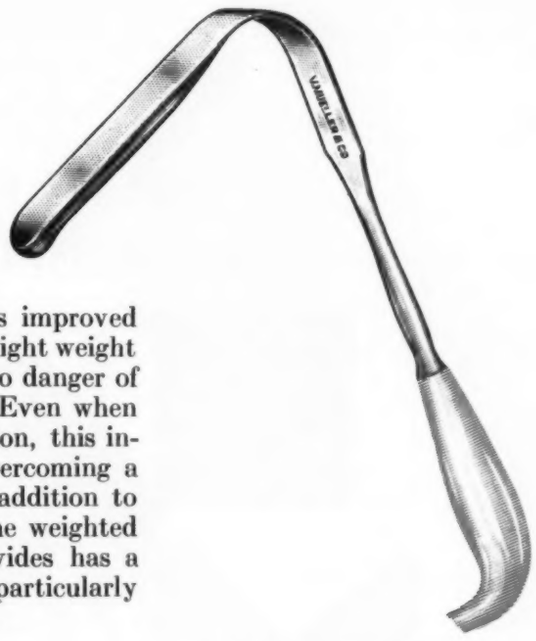

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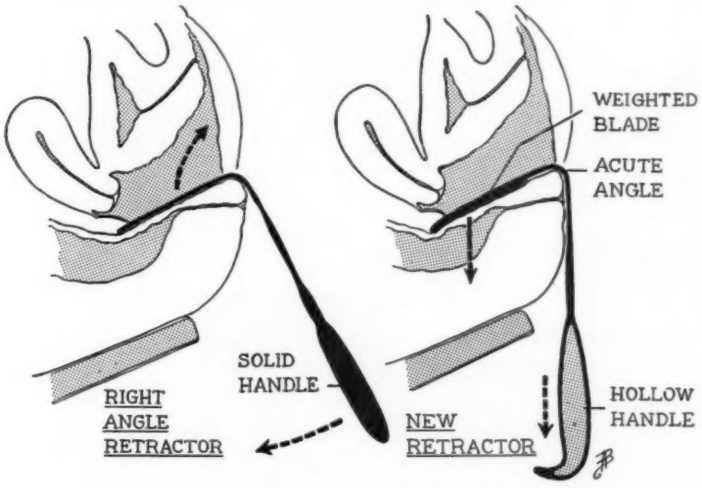

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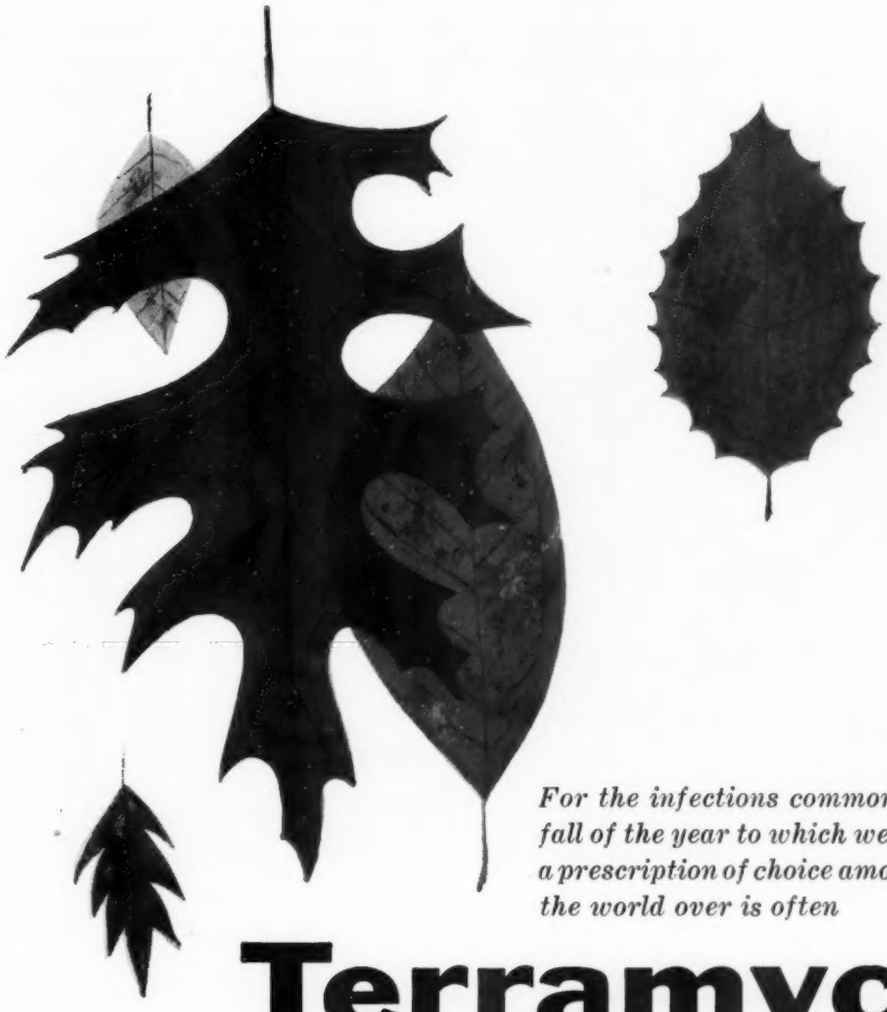

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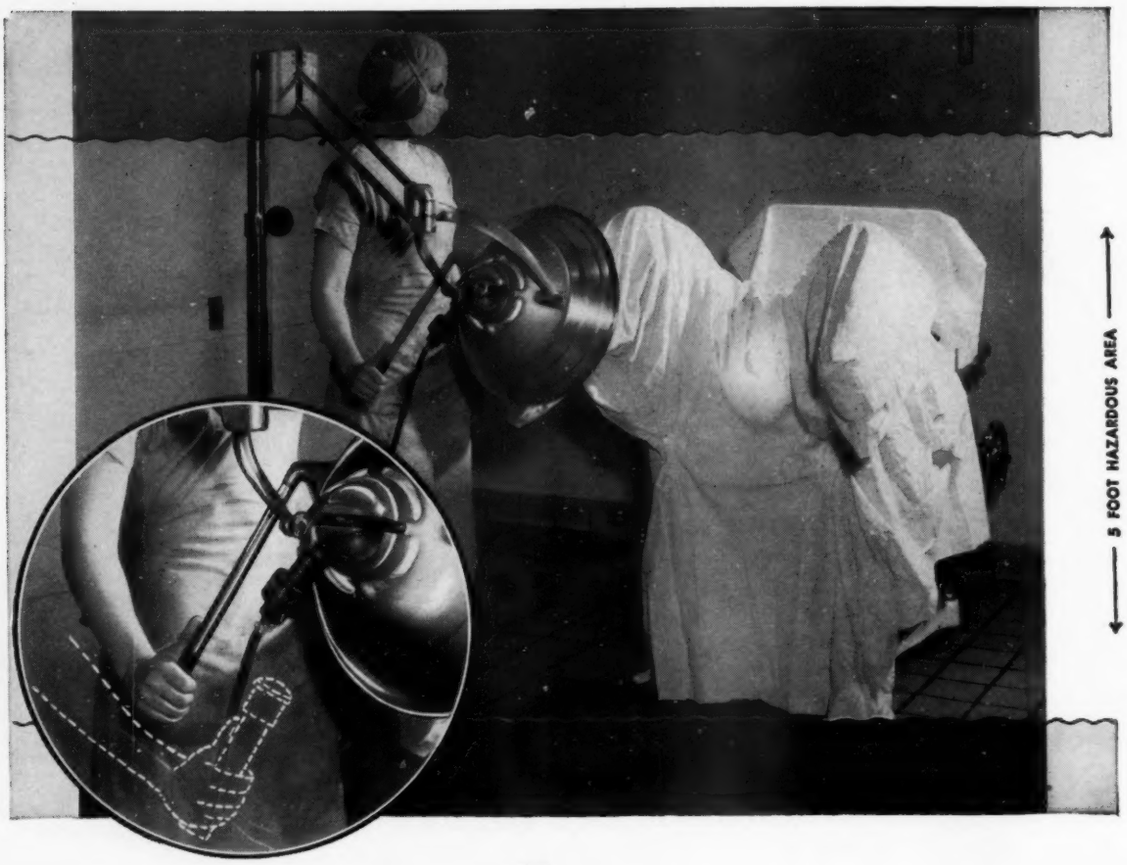

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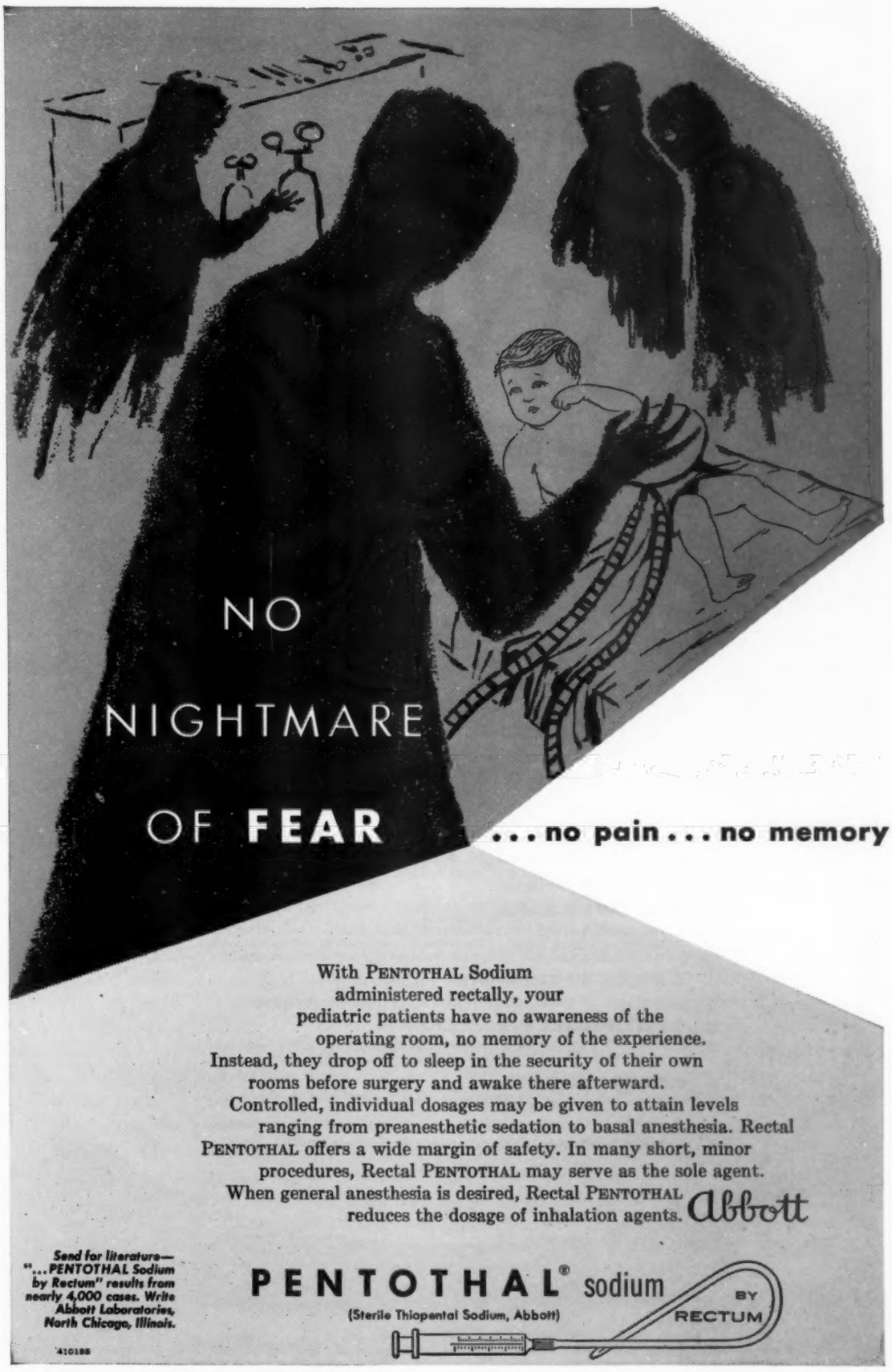

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Editorial

LONGEVITY IN CANCER

THERE was a time when the surgeon and radiologist pointed with pride to their five-year survivals in cancer. An isolated case in the literature from time to time would report a ten-year or even a twenty-year survival. Some were treated with surgery or radiation, others were not treated at all. The number of unreported similar cases has never been estimated. However, a report by Harrington[1] from the Mayo Clinic gives a statistical review of 4,563 cases of fifteen to forty years' survival following radical mastectomy for cancer of the breast. Thirty-five of these patients lived thirty-five to forty years following radical mastectomy. Another report comes from the University of Rochester (N.Y.) by Morton and Morton[2] who report seventeen cases of cancer originating in various organs that had not been completely removed. The average time of survival was 12.2 years. Two patients survived twenty-four and twenty-six years, respectively. What surgeon or radiologist has not seen one or more ten-year or longer survival in his institution during the years of his practice?

The surgeon or radiologist who achieves many years' survival in cancer has the right to be proud of his achievement. However, can he duplicate such an achievement at will in other cases with the same type of malignancy? Some of these patients may die with general metastasis within a year. The surgeon or radiologist may be the same, the method of treatment the same, the pathology the same; but the patient is different. Why do some patients die when they are expected to live and others live for many years when they are doomed to die, according to our great authorities in cancer?

The successful treatment of cancer does not always depend on the skillful hand of the surgeon. He often fails to prevent a recurrence or metastatis in cases which are identical in every respect with others in which a ten-year or longer survival was obtained. The radiologist often meets with the same disappointment. Tumors which are known to be radiosensitive will fail to respond to radiation, while definitely known radioresistant tumors will disappear without recurrence. The surgeon in "the way of all flesh" will consider the successful case a surgical triumph and conclude that surgery is the treatment of choice in cancer. The radiologist under the same circumstances will show proof that radiation is the treatment of choice. What is to be blamed for the surgical and radiation failures? "The highly malignant tumor" would be the answer. However, the skillful pathologist who has spent a lifetime studying neoplastic disease will tell you that the tumor is the same as the one where a ten-year or longer survival was obtained. Could the pathologist be wrong? Is there "something" in the tumor that the microscope fails

[1] HARRINGTON, S. W. Fifteen year to 40-year survival rates following radical mastectomy for cancer of the breast. *Ann. Surg.*, 137: 843, 1953.

[2] MORTON, J. J. and MORTON, J. H. Cancer as a chronic disease. *Ann. Surg.*, 137: 683, 1953.

to reveal? It seems more likely that there is something in the patient that controls, combats and destroys tumor formations.

Connheim believed that tumors develop from masses of simple or complex tissue misplaced during embryonic life. This theory was universally accepted. By the same token, why are we not born with an anticarcinogenic factor which holds the aberrant tissue under control; combats, prevents, retards and destroys tumor formations? When a malignant tumor does form and is subsequently removed, recurrence or metastasis is retarded or prevented by the anticarcinogenic factor. Hence one patient will survive ten or more years without metastasis while another will die with general metastasis within a year, depending upon the amount of anticarcinogenic factor present in the body.

If we wish to find the secret of long survivals in cancer, let us establish clinics for cancer patients who have survived for ten or more years after the onset of the disease. Let us find what these patients have, for the lack of which others with similar disease die prematurely. Let us study their physiology and biochemistry, their blood, secretions and excretions. When these patients are no longer ambulant, they should be admitted to hospitals for further study. Soon after death let the biochemist as well as the pathologist study their glands of internal secretion and other organs. It is the study by the former that is woefully neglected.

Laboratory animals have contributed a great deal to our knowledge of cancer. If only we could humanely study the human being with cancer with the same precision as we study the laboratory animals! If only we could study human cancer in humans! No matter how similar the laboratory animal is to the human being, it is still only a laboratory animal; the findings still have to be translated into terms of the human, and the translation is not always the same.

Let us unravel the secret that keeps some cancer patients alive when others die. What is the anticarcinogenic factor which they have that the others lack? Let us find it and perhaps we will be able to prolong the lives of all cancer patients.

HERMAN CHARACHE, M.D.,
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Staphylococcus Pseudomembranous Enterocolitis, a Complication of Antibiotic Therapy

GEORGE S. SPEARE, M.D.,* *Boston, Massachusetts*

In the past five years the medical profession has become aware of the increasing incidence of cases of pseudomembranous or diphtheritic enterocolitis found at necropsy. It has been suggested that the increase of the incidence of these cases runs parallel with the universal use of antibiotic drugs. Surgeons throughout this country and abroad are especially concerned with the frequent reports of this condition as a fatal complication in postoperative cases.

In many of these patients bacteriologic studies show that antibiotic-resistant Staphylococcus aureus exists in pure culture in the feces and the intestinal lesions and is considered the main etiologic factor in the fatal outcome. It is generally accepted that a resistant staphylococcus has developed as a result of antibiotic therapy in recent years.

This staphylococcus is present in the nose, throat, skin and feces of many people, both patients and hospital personnel. It is usually found in small numbers and causes no trouble. However, in rare cases in which the normal bacterial flora of the gastrointestinal tract are destroyed or depressed by antibiotic therapy, this staphylococcus grows rapidly in large numbers and produces the overwhelming infection found in pseudomembranous enterocolitis.

Pseudomembranous or diphtheritic enterocolitis has been observed by pathologists at autopsy for many years. However, they have not been able to ascribe to it any clinical significance.

In 1893 Finney[1] reported a case of bloody diarrhea occurring ten days after a gastric operation. The patient died five days later and autopsy showed diphtheritic enteritis of the terminal ileum and colon. No enteric pathogens were found.

In 1902 Riedel[1] described five cases in which anatomic diphtheritic lesion of the intestine was found. These patients were all postoperative and died with a clinical picture of diarrhea and circulatory collapse within four or five days from the onset of their symptoms. He believed that the protracted operation, loss of blood, anesthesia, preoperative weakness and anemia united to make the intestine unable to resist its own contents. This diphtheria of the intestine, he said, was nothing more than a superficial necrosis of a poorly nourished mucosa.

In 1910 Wertheim[1] mentioned diphtheritic enteritis in three patients in a series of 500 cases of radical pelvic exenteresis for carcinoma of the cervix.

In 1920 Goldschmidt and Muleder[1] noted thirty cases of diarrhea in 500 gastric operations. They described three typical cases of postoperative diarrhea, collapse and death with an anatomic diphtheritic lesion in the lower ileum and colon. They found no pathogens in the stool.

Penner and Bernheim[2] surveyed the records of the Mount Sinai Hospital from 1929 to 1939 and found forty cases in which necropsy showed pseudodiphtheritic ulceronecrotic enteritis, colitis or enterocolitis. Complete data were available in twenty instances. They were all postoperative patients of various kinds. The clinical picture of postoperative diarrhea and collapse and the anatomic diphtheritic lesion of the intestines were present in their typical

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cases reported in detail. They describe the histologic picture of the lesion and consider the mechanism of production a manifestation of shock which was present in all the patients. They state that similar lesions have been observed following experimental production of shock in animals.

Penner and Druckerman,[3] in a ten-year study from 1939 to 1948, present nine cases after various operations showing at autopsy this diphtheritic lesion which they consider non-specific, resulting from shock followed by secondary infection.

Dixon and Weismann[4] in 1948, reviewing the records of the Mayo Clinic for a ten-year period, found twenty-three cases following a variety of surgical operations. The clinical picture in these patients was rapidly progressing circulatory collapse extremely resistant to supportive and resuscitative measures and resulting in irreversible shock and death. Autopsy in all these cases showed the characteristic picture of pseudomembranous enterocolitis, with the small bowel and superior colon mostly involved. These authors observed increase of the incidence of these cases in the last two or three years of the period their study covered.

Kleckner and his associates[5] at the Mayo Clinic, for the ten-year period from 1940 to 1950, found fourteen cases of pseudomembranous enterocolitis in which the disease was not preceded by an operation. The clinical picture and the autopsy findings were the same as in the postoperative cases described by Dixon and Weismann.[4]

Staphylococcus Cases. In the past five years evidence has been accumulated showing a definite increase, especially in the number of postoperative cases of pseudomembranous enterocolitis, in this country and abroad. Coincident with the increase of this complication is the appearance of antibiotic-resistant strains of Staph. aureus.

In practically all the recent reports of these cases pure cultures of strains of Staph. aureus resistant to penicillin, streptomycin, aureomycin and terramycin® have been found in the stools and the intestinal lesions of these patients. In most cases the normal intestinal bacterial flora have been absent or depressed. Therefore, the concept has been formulated by various investigators that the etiology of this fatal complication is the massive invasion of the intestinal mucosa by antibiotic-resistant strains of Staph. aureus, facilitated by the absence of the normal bacterial flora which is known to exert an inhibitory influence on the growth of this organism. The antibiotics routinely used as a prophylaxis or treatment in these patients suppress the intestinal flora and thus indirectly are partly responsible for the occurrence of this dreaded complication.

Prissick,[6] in a comprehensive article on antibiotic-resistant staphylococci, describes in detail the evolution of the resistant strains of this organism and states that at the present time the increased prevalence of antibiotic-resistant staphylococci is an accepted situation. He finds that the hospital population harbors the resistant strains in 50 per cent of the personnel and considers cross infections a common occurrence. The incidence of carriers outside of the hospitals is about 25 per cent.

Barber,[7] Finland[8] and Needham[9] all report gradual increase of resistance of staphylococci to the commonly used antibiotics until at the present time, 75 per cent of the strains of these organisms are resistant to penicillin and 30 to 50 per cent resistant to aureomycin, terramycin and streptomycin. The resistance to chloromycetin® is found to be less because this drug is less widely used. None of the strains were found resistant to erythromycin, one of the latest antibiotics developed.

During the past four or five years independent observations were made in different centers of the increasing incidence of various infections with resistant strains of Staph. aureus. In the Children's Hospital in Montreal staphylococcus pneumonias in infants rose from 2.8 per cent in 1942 to 11.8 per cent in 1951, in which year sixteen of twenty-nine such patients died.

Finland[10] found increasing staphylococcal infections in the wards of the Boston City Hospital. He was especially impressed with the appearance of staphylococcal pneumonia and enterocolitis which appeared in patients treated with the broad spectrum antibiotics. In ninety-one cases of pneumonia treated with aureomycin and terramycin, he reports four deaths due to staphylococcus enterocolitis which developed as a complication of the antibiotic therapy.

Womack et al.[11] from the same hospital report one fatal case of staphylococcus enterocolitis in 100 urologic infections treated with terramycin.

In London in 1948 Kramer[12] reported on a six week old girl who developed staphylococcus enteritis after penicillin and streptomycin therapy and died.

A number of typical cases of pseudomembranous staphylococcus enterocolitis were reported recently by Hilsabeck and Dixon,[13] Dearing and Heilman,[14] Fairlie and Kendall,[15] Brown,[16] Hansbro[17] and Terplan.[18] I was able to collect from recent reports twenty-two such cases with nineteen deaths and three survivals. Most of them are postoperative cases and all were treated with antibiotics.

The clinical picture and the autopsy findings in the staphylococcus cases are the same as in the cases found at necropsy in the past. The patient usually makes a good recovery from twenty-four to forty-eight hours after the operation. At this time some abdominal pain and nausea may develop. His temperature may be slightly elevated but no more than one would expect in the immediate postoperative period.

In most cases diarrhea will start and become profuse, the patient passing large quantities of rice water stools. In the next twenty-four to forty-eight hours the condition of the patient deteriorates very rapidly and becomes critical. The temperature is markedly elevated, reaching 105°, 106° or even 107°F. The pulse goes up to 120 or 160. The respirations are only slightly elevated, unless there are associated pulmonary complications.

The patient goes into a state of shock with cyanosis, coldness and mottled appearance of the skin. The blood pressure frequently drops to zero and the pulse is unobtainable. The patient becomes lethargic, stuporous, semicomatose or altogether unconscious.

Urinary output is diminished or totally suppressed. There is marked dehydration, the patient losing enormous amounts of fluid into the bowel and through the rectum. The electrolytes fall. Replacement of fluids and other supportive measures may bring about some improvement, but usually in a few hours or a day or two the patient succumbs.

The diarrhea may diminish or stop before the end because of the increasing paralytic ileus. However, enormous quantities of fluid continue passing into the lumen of the dilated bowel. The abdomen is usually moderately distended with some general tenderness.

Inasmuch as most of these patients have had abdominal operations and many of them bowel resections or anastomoses, the differential diagnosis is difficult. Many times an abdominal exploration is carried out on a critically ill patient because complications such as peritonitis, intestinal obstruction and leaking anastomosis cannot be ruled out.

Autopsy Findings. The anatomic picture in all these cases is the same. The lesion may involve the entire gastrointestinal tract from lower esophagus to rectum. However, the segment of the bowel most commonly involved is the ileum and the upper colon.

The small bowel is more frequently involved than the large. The bowel is found dilated and contains large amounts of cloudy, yellowish brown fluid. On opening it, the mucosa is denuded. There are segments of a yellowish gray, grayish brown or green diphtheritic membrane found attached to the denuded surface of the bowel or floating loose in the liquid contents.

Histologically, there is intense hyperemia of the submucosa and vascular engorgement with edema of the stroma. There is exudation of erythrocytes, polymorphonuclear leukocytes, lymphocytes and plasma cells. The muscularis and serosa are involved only in extreme cases. The mucous membrane is undermined by this inflammatory process. It becomes necrotic, peels off and with the cellular debris and bacteria forms the diphtheritic membrane. Perforation is rare.

In the recent twenty-two cases staphylococcus was found in large numbers and in clumps, both in the pseudomembrane and the active lesions in the intestinal wall. Bacteriologic studies of the liquid contents yielded pure culture of this organism resistant to the commonly used antibiotics. The normal bacterial flora were suppressed.

In the earlier cases bacteriologic studies were not always performed, and only the absence of enteric pathogens was reported when cultures were taken. It is possible that the culture media employed would probably not grow staphylococcus.

All the staphylococcus cases reported had been receiving one or more of the antibiotics either as prophylaxis or treatment. Aureomycin and terramycin are more frequently mentioned in the reports. Chloromycetin was mentioned only once. Erythromycin has been found effective in these staphylococcus infections and

was used successfully in two patients who survived.

Diagnosis and Treatment. The diagnosis of the condition is difficult to make because it simulates such serious complications as peritonitis, strangulating obstruction, coronary occlusion or pulmonary embolism.

The onset of diarrhea, sudden rise of temperature and shock-like state in a patient receiving antibiotics should arouse one's suspicion of the possibility of this complication. A stool smear and culture should be done immediately. If gram-positive cocci are found in the direct smear, the antibiotics which the patient is receiving should be stopped, and erythromycin, to which staphylococci are not resistant at present, should be substituted until culture and sensitivity test of the organism present are determined. The appropriate antibiotics can then be administered. At the same time immediate and aggressive treatment of shock should be instituted. Blood, blood substitutes, fluids and electrolytes should be pushed vigorously to correct the marked depletion. The patient is losing enormous quantities of fluids and electrolytes into the intestinal tract. In order to replace these losses rapidly it is necessary to administer fluids through two or three intravenous portals at the same time. In one of the published cases the loss of fluids was estimated at as much as 16,000 cc. in one day. Vasopressor drugs, oxygen and cardiorespiratory stimulants should be given as indicated by the clinical condition of the patient.

The disease runs a fulminating course, usually with a fatal outcome in about three to eleven days. Only three of the twenty-two cases which I collected from the recent literature survived. Two of those received erythromycin. The role of this drug may alter the gloomy picture. Its value has only been recognized recently and it was not available when most of these cases occurred.

At the Massachusetts General Hospital we have had eight patients in the last three or four years with a clinical course similar to those reported from other centers. In some of them Staph. aureus resistant to the commonly used antibiotics was found.

CASE REPORTS

CASE 1. M. G. H., No. 746943. A fifty-seven year old white married man was admitted to the hospital on April 24, 1953. Previous studies had shown two polyps in mid-sigmoid. The patient's general condition was good. The urine was negative. The blood hemoglobin was 14.2 gm. The white blood count was 8,700, the non-protein nitrogen, 24 and the prothrombin time, 83 per cent.

He was given sulfathalidin®, 8 gm. a day for five days, and streptomycin by mouth, 1 gm. a day for two days, before the operation.

On April 29, 1953, a sleeve resection of the segment of the sigmoid containing the polyps was carried out under spinal anesthesia. The continuity of the bowel was re-established by end-to-end open anastomosis. He received two blood transfusions during the operation.

The patient's condition was good for the first two postoperative days. The abdomen was soft. Peristalsis had started and he was receiving small amounts of clear fluids by mouth. The Levin tube was removed from his stomach at the end of the second day. His temperature was a little elevated. He was receiving 100,000 units of penicillin and 0.25 gm. of streptomycin intramuscularly four times a day after the operation.

On the morning of the third postoperative day his temperature rose to 103°F. and pulse to 120. He felt poorly but had no specific complaints. The abdomen was soft and non-tender. The wound looked normal. He was passing gas by rectum. The chest was clear. X-rays of the chest were taken and showed no abnormality. Later in the day his temperature dropped to 101°F. and the pulse to 100. He was taking fluids by mouth.

Toward evening he had two diarrheal movements and vomited. Stool cultures were planted, but no direct smears were made. The penicillin and streptomycin were omitted. At this point we were thinking of staphylococcus enteritis and were considering administration of erythromycin but waited for the result of the stool culture.

The patient was put on gastric suction and blood and fluids were administered vigorously. One hundred per cent O_2 was given through nasal tube.

At about midnight the condition of the patient became worse. He became lethargic, confused and had to be restrained because he kept pulling out his gastric suction tube. The temperature rose to 104°F. The abdomen became moderately distended with some gener-

alized tenderness but no spasm. He continued with diarrhea and vomiting. Peristalsis was heard by some observers, but others were not certain about it. The urine showed 40 or 50 white blood cells per high power field. He started coughing and his lungs filled with coarse rales.

Early the next morning, the fourth postoperative day, he was in shock, his skin was cold, mottled and cyanotic and blood pressure was 64/40. The temperature rose to 105°F., the pulse to 140, respirations 35 to 40. He was disoriented and confused. He had passed only 10 to 20 cc. of urine through the Foley catheter in the last seven to eight hours. His lungs were clear of rales and he was not coughing. The abdomen remained moderately distended with some guarding tenderness localized in the left lower quadrant in the region of the anastomosis. No peristalsis could be heard.

The incision appeared healthy; rectal examination was negative. A slight amount of subcutaneous emphysema was noted on the left side of the abdomen, extending up to the left axilla. The white blood count rose to 16,000. The diarrhea had stopped. Blood transfusions, fluids and electrolytes were given through two portals to combat shock and anuria.

In evaluating the clinical picture the fourth day, we believed that we could not rule out leakage in the anastomosis, causing peritonitis and subcutaneous emphysema. Therefore, a transverse colostomy was decided upon as a means of diverting the fecal stream from the presumably leaking anastomosis.

Under local anesthesia a small transverse incision was made in the right upper quadrant. There was a small amount of clear fluid in the abdominal cavity. The small bowel was somewhat distended, edematous and acutely inflamed. The colon was not as markedly involved. A loop of transverse colon was exteriorized for future colostomy. A small McBurney incision was also made in the left lower quadrant. The same type of clear fluid was found. A finger was inserted in the region of the anastomosis but did not reveal the presence of a mass or induration. This incision was closed without drainage.

The patient continued in profound shock in spite of the vigorous replacements of fluid losses with blood, plasma, fluids and electrolytes. Vasopressor drugs and 500 mg. of aureomycin were administered intravenously.

He remained semi-comatose. His non-protein nitrogen rose to 125. His blood pressure and pulse would become perceptible for a while, only to disappear again two to three hours later. The diarrhea stopped.

He died at the end of the fifth day after the first operation and thirty-six hours after the second. On the day of his death the result of the stool culture was reported. It showed abundant Staph. aureus resistant to terramycin, aureomycin, streptomycin and penicillin, but sensitive to bacitracin and chloromycetin.

At autopsy gross examination of the peritoneal cavity revealed that it contained an estimated 1,500 cc. of a clear, slightly blood-tinged fluid. The peritoneal surfaces were smooth and normal except directly beneath the two scars where there was a small amount of yellow fibrinous exudate.

The stomach contained an estimated 50 cc. of fresh blood and the mucosal surface was diffusely flecked with small petechial hemorrhages.

The sigmoid anastomosis, which was roughly 25 cm. above the rectum, was intact with no evidence of leakage. The portion of transverse colon which had been pulled above the skin to form the colostomy showed moderate inflammation of both the serosa and the mucosa but otherwise appeared normal. The entire small bowel was slightly to moderately dilated and its serosal surface from the ligament of Treitz to the ileocecal valve was diffusely reddened and inflamed but without exudate. On opening, the small bowel was filled with a thin, watery, brown fluid. In addition, throughout the entire length of small bowel the mucosa had been sloughed off, leaving a raw, finely granular surface dotted with occasional petechiae. This slough was grayish green, soft, necrotic and lying loose in the lumen. Parts of it measured up to 30 cm. in length and formed perfect casts of the mucosal surface. This inflammatory process ended rather abruptly at the ileocecal valve and the entire length of large bowel, although coated by a slimy mucoid material, appeared normal. At the ligament of Treitz the process ended gradually over a distance of 3 to 4 cm.

The lungs weighed 1,830 gm. and on sectioning were markedly congested and edematous throughout. In addition, in the apex of the right upper lobe extending to within roughly 0.5 cm. of the pleural surface was an ill defined, firm, grayish red nodule measuring 2.5 cm. in

diameter. In both lower lobes there were areas of questionable granularity.

Microscopic examination of the lungs revealed that a pneumonic process was present, confluent in places, with most of the alveoli containing many neutrophils. In addition there were multiple small pus-filled abscesses, all of which contained colonies of cocci. All sections showed marked congestion and edema and many alveoli contained pigment-filled macrophages.

Sections from the entire small bowel from duodenum to ileum showed inflammatory changes, most severe in the ileum and jejunum. The mucosa in all areas was heavily infiltrated with inflammatory cells which consisted mostly of plasma cells and a few lymphocytes and monocytes. There were very few neutrophils. In the duodenum most of the villi remained although the mucosal glands, except for those most basally situated, had been destroyed. In the remainder of the small bowel the mucosa was very thin, consisting of necrotic villous stumps, a few partially destroyed glands, the inflammatory infiltrate, congested blood vessels and edema. The submucosa, muscularis and serosa contained a less intense but similar inflammatory infiltrate. Some of the submucosal vessels contained but were not occluded by, small recent fibrin thrombi. The sloughed portion of the mucosa described grossly consisted of necrotic mucosa, colonies of cocci and disintegrating red and white cells.

A section of the large bowel showed a mild inflammatory infiltrate throughout all layers of the same type seen in the small bowel, but without the mucosal necrosis.

Bacteriologic examination of heart blood and stool culture revealed abundant Staph. aureus and few heat-resistant streptococci. The heart was negative.

Case II. M. G. H., No. 797053. A 56 year old married man was admitted to the hospital on January 22, 1953, with a large bowel obstruction of four days' duration.

A cecostomy was performed soon after arrival as an emergency procedure. The obstruction was relieved. Postoperatively, the patient was given 100,000 units of penicillin and 0.25 gm. of streptomycin intramuscularly four times a day for four days. Sulfathalidine, 8 gm. a day, was then given for five days to prepare the bowel for resection. The patient's condition was good. Blood chemistry and urine were normal. Blood pressure was 110/80.

On January 30, 1953, a left colectomy with an end-to-end anastomosis was carried out under spinal anesthesia. A constricting carcinoma of the splenic flexure was found. Several blood transfusions were given. Penicillin, 100,000 units, and streptomycin, 0.25 gm., were given intramuscularly four times a day after the second operation.

The patient did well for the first two postoperative days. The third day he became difficult to handle and vomited. His temperature rose to 104°F. and later in the day to 105.8°F. The pulse rose to 140 and respirations to 35. His skin became cold and clammy. The abdomen was silent, but there was no tenderness. Rectal examination was negative. A Levin tube drained large amounts of guaiac-positive fluid from the stomach. A Foley catheter produced small amounts of urine.

During the third day the patient received 6,500 cc. of fluids with dextrose and electrolytes and 400 mg. of aureomycin intravenously. The fourth day he improved slightly. His temperature was a little lower, he was putting out more urine and he was more rational.

Stool culture from the cecostomy on this day showed moderate growth of Staph. aureus, colon bacilli and beta hemolytic streptococci. The white blood count was 11,200 and urine showed 20 red blood cells and few finely granular casts.

The clinical picture at this point was that of overwhelming sepsis, but we could find no focus to account for it. The cecostomy wound looked inflamed, but there were no signs of acute sepsis. The abdominal operative wound showed marked tenderness and induration.

The penicillin and streptomycin were now omitted and aureomycin, 500 mg., given intravenously. On this day the patient received 5,000 cc. fluids with dextrose and electrolytes.

Because intra-abdominal disease could not be ruled out, the patient was explored the fifth postoperative day. The entire bowel was found to be edematous and distended. No point of obstruction was found. Grayish fluid with what appeared to be flakes of necrotic mucosa was aspirated from the small bowel. Fluids, aureomycin and vasopressor drugs were continued.

His condition gradually deteriorated. The blood pressure dropped, the temperature rose

to 107°F. and he died the following day. Permission for autopsy unfortunately was not given. The clinical diagnosis was acute staphylococcus enteritis.

CASE III. M. G. H., No. 338586. A seventy-six year old man was admitted to the hospital because of rectal bleeding. In March, 1950, a lemon-sized polyp was delivered through the anus and excised. The patient left the hospital before the pathologic report was available. The histologic examination of the polyp showed adenocarcinoma, grade 1. The patient refused readmission for consideration of further treatment.

He remained well until April 29, 1952, when he was readmitted with carcinoma of the cecum. He was prepared for operation with sulfathalidine, 8 gm. a day for five days, and streptomycin by mouth, 1 gm. a day for two days. The preoperative blood chemistry and urine were normal.

On May 5, 1952, a right colectomy with ileotransverse anastomosis was carried out under spinal anesthesia. The pathologic report of the tumor was colloid adenocarcinoma, grade III.

He did well for twenty-four hours except for some rise of temperature and pulse. The second postoperative day the temperature rose to 105°F., pulse was 130 and respirations 30. The third day he was passing large amounts of rice water stools, and gastric suction was yielding large amounts of yellow fluid. He was in a state of shock, hypotensive, anuric, dehydrated and confused. Vigorous replacement of electrolytes and fluids was given and vasopressor drugs were administered. The clinical diagnosis of fulminating enterocolitis was made.

The fourth day the diarrhea decreased, the systolic blood pressure dropped to 40, then rose to 70. The patient passed a little urine. The improvement was only temporary. His condition deteriorated and he died during the night, early on the fifth postoperative day. The abdomen was only moderately distended and the lungs were clear during the critical period of his illness. No stool cultures were made and unfortunately, autopsy was refused.

CASE IV. M. G. H., No. 144301. A fifty-six year old white married man was admitted to the hospital February 19, 1953. Previous studies had demonstrated several polyps scattered throughout the colon.

He was given 8 gm. of sulfathalidine a day for two days in preparation for operation. The preoperative condition was good. The blood pressure was 150/95. Blood and urine were normal.

On February 21, 1953, a partial colectomy was carried out, anastomosing the ileum to the sigmoid and removing 120 cm. of bowel. There were eight polyps scattered throughout the specimen removed. Penicillin, 100,000 units and streptomycin, 0.25 gm., were given intramuscularly four times a day postoperatively.

He made a good recovery and was doing well for two days after the operation. On the third day diarrhea began and his temperature started to rise. At 8:00 A.M. the fourth postoperative day his temperature had reached 103°F., but the patient had no specific complaints. The diarrhea continued. In a few hours he was in a state of shock. The pulse was unobtainable, the skin was mottled and cold and the blood pressure had dropped to 100/70. Smear from the stool showed numerous gram-positive cocci in clumps. No gram-negative organisms were seen. Stool culture showed both Staph. aureus and coliform bacilli. The white blood count was 5,400; hemoglobin, 15.3 gm.; blood culture, negative.

A working diagnosis of staphylococcus enteritis was made. The patient was given 0.3 gm. of magnamycin® by mouth four times a day. The penicillin and streptomycin were omitted. Aureomycin, 500 mg., was given intravenously and sulfadiazine, 4 gm. a day by mouth, was started. Fluids, electrolytes and oxygen were administered immediately.

During the third postoperative day he received 4,900 cc. of fluids and put out about 4,000 cc. The abdomen was soft and peristalsis quiet. The lungs were clear. The electrolytes remained normal except for the CO_2 which dropped to 12 volumes per cent.

The next day the clinical picture was worse. The shock-like state continued, the sensorium was less clear, diarrhea continued, the abdomen was soft and peristalsis present. Parenteral fluids, aureomycin and sulfadiazine were continued.

The next two days there was remarkable improvement. The diarrhea diminished and stopped. Aureomycin was discontinued, but sulfadiazine was kept up. From here on the patient steadily improved and was discharged well nineteen days after the operation.

Five days after discharge he was readmitted with fever. A small abscess was found in the

left lower quadrant at the region of the anastomosis and drained. The culture from the pus showed Staph. aureus. He subsequently developed phlebitis and had bilateral superficial femoral vein ligation. He was discharged April 15, 1953, completely well.

CASE V. M. G. H., No. 674815. A sixty-seven year old man was admitted to the hospital August 27, 1949. He gave a history of two and a half years of anorexia and weight loss with increasing constipation during the past six months. Three weeks prior to admission anal pain and tenesmus had developed.

He was prepared for exploration with 8 gm. of sulfathalidine a day for three days and streptomycin, 4 gm. by mouth, given over a period of three days before surgery. Blood chemistry and urine were normal.

On August 30, 1949, laparotomy was carried out through a left lower paramedial incision. There was only diverticulosis present in the large bowel. The liver was granular and the gallbladder was large and contained stones. Consequently, a transverse incision was made in the right upper abdomen and cholecystectomy performed. The common duct was found small and was explored. No stones were found.

Postoperatively the patient was given 400,000 units of penicillin and 1 gm. of streptomycin intramuscularly daily for eight days. The patient did fairly well for the first two postoperative days, except that he appeared drowsy and lethargic.

The third day the temperature rose to 104°F.; pulse, 120; and respirations, 40. Toward evening diarrhea started. He became disoriented and refused to take anything by mouth. X-rays showed right lower lobe atelectasis.

The fourth day he had a great deal of respiratory difficulty, and he could not cough up sticky bronchial secretions. The diarrhea continued. The temperature rose to 105°F. He was disoriented and semi-comatose. The extremities became cold and cyanotic. The systolic blood pressure dropped from 110 to 70. The abdomen remained soft and non-tender. Peristalsis was present.

Vigorous replacement of fluids was carried out with blood and electrolytes. The white blood count was 8,800; the hemoglobin, 11 gm. The blood chloride dropped to 47 and the CO_2 to 16.4. The non-protein nitrogen rose to 58.

The fifth and sixth days the choleriformic clinical picture continued, in spite of massive replacement of fluids and electrolytes. Copious rectal discharges of clear fluid with mucus but without blood continued the following two days, and he still remained in a state of shock. The intake of fluids was pushed up to as high as 12,000 cc. one day with 11,000 cc. output, mostly by rectum. His condition deteriorated, and he died the eighth postoperative day. The urinary output was kept up to the end.

The autopsy showed the large and small bowel filled with a fluid of ground glass appearance. The mucous membrane was slightly edematous. In the terminal ileum the lymphatic follicles in the submucosa were very prominent. There were numerous diverticuli in the sigmoid.

Culture of intestinal contents showed Bacillus coli overgrowing beta and non-hemolytic streptococci. The lungs showed bronchopneumonia in the left lower lobe.

This patient represents an instance of fatal enterocolitis in which antibiotics were given but no staphylococcus was found in the intestinal contents.

CASE VI. M. G. H., No. 801472. A fifty-nine year old white married man entered the hospital February 10, 1953, with malaise, fever, chills, nausea and hiccups of two and a half weeks' duration. He had received 750 mg. of terramycin a day for four days prior to admission. He had had diabetes for twelve years and was receiving 12 units of insulin a day. He had taken several glasses of whiskey a day for a period of ten to fifteen years.

A diagnosis of pneumonic process of unknown etiology and compensated cirrhosis was made. Penicillin and streptomycin were administered. Soon after admission diarrhea developed, up to fourteen stools a day. Stool cultures showed pure growth of hemolytic Staph. aureus. Sensitivity tests revealed it to be resistant to aureomycin, terramycin and penicillin, but sensitive to streptomycin, chloromycetin and erythromycin.

The diarrhea continued for about ten days with the clinical picture of staphylococcus enteritis as the dominant feature. The white blood count varied from 4,000 to 6,000. The fever continued. He was treated with erythromycin, chloromycetin, sulfadiazine, blood transfusions and parenteral fluids. About ten days after admission the diarrhea stopped. The stool culture became negative for staphylococcus and contained abundant coliform bacilli.

However, the patient's chest condition became worse. Peripheral edema developed and he eventually died thirty-five days after admission. The staphylococcus enteritis had cleared, however, and he was passing normally formed stools.

Autopsy showed miliary tuberculosis involving the lungs, liver, spleen and kidneys, and pyelonephritis. The intestines showed scattered, ill defined areas of mucosal injection but otherwise showed no abnormality.

This case represents a complication of severe staphylococcus enteritis in a patient acutely ill with miliary tuberculosis to which he eventually succumbed. However, his enteritis cleared with fluids and appropriate antibiotics. The staphylococcus was eliminated from the stool and normal bacterial flora returned at the end of ten days.

CASE VII. M. G. H., No. 824832. A seventy-seven year old white laborer was admitted to the emergency ward four hours after a fall in which he sustained intertrochanteric fracture of his left femur. On admission he was found to have hypertensive heart disease with borderline congestive failure and emphysema.

Because of his poor condition surgery was postponed, and his leg was put in traction while digitalization and other measures were carried out to improve his general condition. Laboratory studies showed the urine to be negative. The white blood count was 13,000; the hemoglobin, 11.8 gm.; the non-protein nitrogen, 35; chlorides, 98; CO_2, 26.

Soon after admission he was given penicillin, 800,000 units, and streptomycin, 1 gm. intravenously every day. His temperature was elevated up to 100°F. Three days after admission right hemiplegia developed and the patient became almost semi-comatose.

Five days after admission severe watery diarrhea developed. His stool culture showed moderate growth of Staph. aureus and beta hemolytic streptococci. The antibiotics were immediately withdrawn. Intravenous fluids and electrolytes were administered vigorously to combat dehydration and depletion. Another stool culture done six days after the onset of diarrhea showed moderate growth of Staph. aureus, beta hemolytic streptococcus, Bacillus proteus and abundant growth of B. coli. The diarrhea continued for ten days, then stopped, and the patient was passing normally formed stools.

His mild pyrexia continued and urinary infection with B. proteus and respiratory infection with B. proteus and Staph. aureus developed. His right hemiplegia persisted. He had an episode of cyanosis and dyspnea with distended neck veins which suggested pulmonary embolus. However, he improved and the x-rays failed to reveal definite lung disease. Chloromycetin, 1 gm. a day, was started for his urinary infection and was continued up to his death. However, the infection continued, he became weaker and eventually comatose. The mild pyrexia continued throughout his illnesses.

On the thirty-eighth day the temperature, pulse and respirations spiked. The next day bilateral parotitis developed and the fortieth day after admission he died, with a clinical diagnosis of urinary tract infection and terminal pneumonia. This was a medico-legal case and no autopsy was performed.

This case represents a complication of staphylococcus enteritis occurring after antibiotic treatment in an elderly cardiac patient with a fractured femur. The staphylococcus diarrhea cleared with fluid therapy and withdrawal of antibiotics. The presence of the normal bacterial flora in his intestines during the staphylococcus enteritis was a significant factor in the elimination of this organism.

CASE VIII. M. G. H., No. 129427. A forty-two year old white married woman entered the hospital December 12, 1949, with a history of mild abdominal crampy pain and vomiting of twenty-three hours' duration. She had been well except for a cholecystectomy three years previous and a hysterectomy with appendectomy two years previously.

On admission her temperature was 99°F.; pulse, 74; white blood count, 13,900; urine, negative; serum amylase, 32; non-protein nitrogen, 18; chlorides, 105; CO_2, 26. The diagnosis was not clear. Pancreatitis, intestinal obstruction and stone in the common duct were the conditions considered. The abdomen was flat and the peristalsis normal with some tenderness to the left of the umbilicus. The patient was passing gas by rectum. X-rays showed gas in some dilated small bowel loops.

Conservative treatment was carried out for four days. However, the abdomen became moderately distended with increasing tenderness. The x-rays again showed dilated small bowel loops in spite of the fact that the patient

was passing gas by rectum. The peristalsis was always present and never increased. Moderate pain continued. Since admission she had been receiving 300,000 units of crysticillin® and 2 gm. of streptomycin intramuscularly daily.

On December 17, 1949, five days after admission, the abdomen was explored through a right lower paramedian incision under gas-oxygen-ether anesthesia. The small bowel was found dilated to about three times its normal size from the ligament of Treitz to a point 8 inches from the ileocecal valve. At this point a fibrous band was found obstructing the small bowel. The band was severed with immediate rush of bowel contents to the segment below the obstruction. The wall of the intestine showed no abnormality. The obstruction was considered to have been only partial because the patient had been taking fluids by mouth, was passing gas by rectum and had passed a large stool the morning of the operation. The condition of the patient during the operation was good. The blood pressure was 120/70 and the pulse, 120. The operating time was fifty minutes.

Two hours after the operation the blood pressure dropped to 70/40; the pulse rose to 130. Definite peristalsis was audible. Later that day a rectal tube was passed and large amount of liquid feces evacuated. The temperature rose rapidly to 102°F. Vigorous anti-shock treatment was started with blood, plasma, electrolytes and fluids. Oxygen was administered and a Levin tube was put in her stomach for suction.

The next morning the blood pressure was up to 100/60, the pulse 110. The skin was dry and the color good. Urinary output, which had been depressed the day of the operation, now improved. However, she continued passing liquid discharges through the rectal tube. The hematocrit was 63; the total protein, 8.5 gm.; CO_2, 19; chlorides, 93; non-protein nitrogen, 50; and sodium, 121. During this day the patient was given 8,000 cc. of fluids, mostly plasma, and electrolytes. The abdomen, however, became distended and the temperature rose to 105°F. The liquid rectal discharges continued.

On the second postoperative day the patient stated that she felt better. The temperature and pulse remained high and the abdomen became more distended with dullness in the flanks. A paracentesis was performed which yielded 20 cc. of pale, yellow, ground glass fluid. The smear showed only 1 to 2 polymorphonuclear leukocytes. The culture reported later showed no growth of any organism. The lungs were clear. The patient was rehydrated, the blood pressure was up to 100/40 and she was passing large amounts of urine. Administration of fluids was slowed up. She was well oriented and talked to her husband. Late in the afternoon her blood pressure dropped, she became disoriented, her skin became cyanotic and she developed moist rales in the lungs. The pulmonary edema cleared in about half an hour with tourniquets in three extremities and aminophyllin. However, she remained in peripheral collapse and died at 7:00 P.M. of the second postoperative day.

Autopsy showed 2,000 cc. of clear yellow fluid in the abdominal cavity. The stomach was not remarkable. The duodenum contained fecal material and was distended. The entire small bowel from the ligament of Treitz to within 50 cm. from the ileocecal valve was distended to 5 cm. in diameter. The serosa was smooth. The intestinal wall was edematous. The mucosa was entirely coated with a pultaceous cast, 0.5 cm. thick. A total of 350 cm. of bowel was involved. The cast spontaneously slid free of the mucosa which was thin and irregularly shallowly débrided.

The large bowel was distended to 7 cm. in diameter. The wall was edematous. There were closely packed patchy areas of fibrin exudate of the mucous surface.

Microscopically, the submucosa and subserosa of the small bowel was widened with edema fluid. The mucosa was degenerated in areas. Where it was recognizable, there was inflammatory infiltrate consisting of leukocytes and monocytes. Attached to the mucosa were fragments of protein exudate which contained inflammatory cells. The capillaries were dilated. The colon showed increasing edema as the rectum was approached, most marked in the mucosa and submucosa. There was protein exudate attached to the mucosa.

Postmortem cultures of the intestinal contents were negative.

COMMENTS

Analysis of our eight cases shows that there were seven males and one female. The ages varied from forty-two to seventy-seven years. Five cases occurred in 1953, two in 1949 and one in 1952. Most of them received penicillin, streptomycin and sulfathalidine before the

development of enterocolitis; one received terramycin.

Diarrhea developed in all of them. Six cases were postoperative and two were non-surgical. Five had some form of intestinal surgery. Five showed Staph. aureus in the stool; three did not.

The white blood count was more often below normal than slightly elevated. Diarrhea, shock-like state, marked depletion, reduction of electrolytes, high temperature and pulse, hypotension and oliguria were the main clinical features in practically all the cases.

Two of the six surgical patients were subjected to a secondary operation during the critical period of their illness because complications demanding immediate surgery could not be ruled out. All were treated with large amounts of blood, blood substitutes, oxygen and electrolytes.

Five died and three survived the enterocolitis, but two of these three died four to five weeks later from their primary disease. Death occurred three to eight days after operation. Of the three that survived the enteritis, one was treated with magnamycin and sulfadiazine, another with erythromycin, chloromycetin and sulfadiazine, and the third with chloromycetin.

Reviewing all the cases of pseudomembranous enterocolitis reported in literature, including our eight patients, one finds that they all present the same clinical and anatomic picture. However, many of the cases reported within the last three or four years, especially during the last one or two years, show the presence of Staphy. aureus in the bowel contents and the intestinal wall lesions. In many of these the staphylococcus exists in pure culture with the normal bacterial flora absent or depressed. In the cases reported before the antibiotic era and in a few of the recent cases, including two of our own, no staphylococcus was found.

Whenever stool cultures were made the reports were that no enteric pathogens were found. Two of our cases (I and VIII) illustrate this point clearly. Clinically and anatomically they are classical cases of pseudomembranous enterocolitis; and yet in one, Staph. aureus was found in large number and pure culture; in the other, bacteriologic studies were negative. This raises the question of whether or not we are dealing with two different groups of cases presenting the same clinico-pathologic picture but of different etiologies, one due to Staph. aureus and the other unknown.

In this connection I should like to mention the report of Reiner and co-workers[19] on five cases occurring in 1950. They demonstrated staphylococcus in one case, the only one in which non-inhibitory media were innoculated. In all the cases reported before the antibiotic era the bacteriologic reports were "no enteric pathogens found." It is possible that in all those cases inhibitory culture media were employed to demonstrate typhoid, paratyphoid and dysentery bacilli. Consequently, Staph. aureus would not be demonstrated even if it were present. If we assume such a possibility, then the role we ascribe to the antibiotics in the pathogenesis of enterocolitis is less significant. Pseudomembranous staphylococcus enteritis, however, has never been reported in the literature until recently in connection with the widespread use of the antibiotics which suppress or eliminate the normal bacterial flora of the gastrointestinal tract, allowing it to grow wild and produce intestinal lesions.

SUMMARY AND CONCLUSIONS

1. The literature on pseudomembranous enterocolitis is reviewed.

2. Eight new cases are presented.

3. An antibiotic-resistant staphylococcus has developed as a result of the widespread use of antibiotic drugs. This organism is harbored by 50 per cent of the hospital personnel, making cross infection a common occurrence. The incidence of carriers outside the hospital is less than 25 per cent.

4. The pseudomembranous enterocolitis cases seem to fall into two groups, identical in their clinical course and pathologic findings, but different in that in the recent cases Staph. aureus has been demonstrated in the intestinal lesions, while in the earlier cases no enteric pathogens were found.

5. To prevent cross infection, strict adherence to the established public health measures and isolation technics should be practiced in the hospitals.

6. The possibility of the existence of this complication should be suspected whenever diarrhea develops in a patient treated with antibiotics. Stool smear should be examined immediately; and if gram-positive cocci are found, the antibiotics used should be withdrawn and erythromycin substituted until sensitivity tests are made. The appropriate antibiotic can then be administered. In the

meantime fluid and electrolyte losses should be promptly and adequately replaced and shock treated with blood, blood substitutes, oxygen, vasopressor drugs, cardiorespiratory stimulants and other supportive measures.

7. Patients who are candidates for major gastrointestinal operations should have a stool culture done before the operation. If staphylococcus is found, it should be eliminated before the operation by erythromycin or one of the newer antibiotics to which staphylococcus has not yet developed resistance. In the postoperative period while the patient is receiving antibiotics, spot checks of stool cultures should be made every two days. If staphylococcus appears at any time, immediate treatment can be instituted before the development of the fulminating infection and circulatory collapse.

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Phrenic Nerve Interruption for Massive Bleeding and Other Symptoms of Hiatal Hernia

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DURING recent years there has been increasing awareness of the role hiatal hernia of the stomach plays in the production of numerous clinical symptoms.[1] Frequently the symptoms closely mimic those of widely divergent diseases such as duodenal ulcer, coronary disease, gastritis, biliary tract disease or even pernicious anemia, with the resultant establishment of an erroneous diagnosis unless hiatal hernia is carefully considered.[2–4] Furthermore, hiatal hernia may occur concomitantly with a disease which it mimics. Finally, it can cause grave complications such as violent hemorrhage, protracted vomiting or sharp, unbearable precordial pain.[5,6] In order to emphasize the merit of phrenic nerve interruption in coping with such situations nine cases are presented herein which involve hiatal hernia complications. Bleeding can be abated and the patient better prepared for more definite surgery—surgery which would otherwise be perilous in view of the patient's critical state. Pain, the exact cause of which is still not clearly established, may be relieved and reflex disturbances of the heart decreased. Co-existing disease in other organs such as the heart or biliary system can in many instances be excluded as the cause of the patient's symptoms, thus clarifying the diagnosis.

Interest in phrenic nerve interruption for diverse complications of diaphragmatic hernia has existed for many years. Jamin[7] in 1906 and Sauerbruch[8] in 1925 recommended phrenic nerve interruption as a temporary expediency in critically ill infants and elderly people with diaphragmatic hernia complications such as obstruction, incarceration and strangulation. Studies by Lemon[9] on the effects of phrenic neurectomy upon diaphragmatic activity led him to believe that phrenic nerve interruption would be extremely useful as a preparatory step in upper abdominal surgery. Facility in repair of a diaphragmatic hernia was enhanced in a case of Goetze's[10] by preliminary chilling of the phrenic nerve on one side. Harrington[11] employed phrenic nerve crush prior to the repair of the hiatal hernia and in those cases in which major surgery was contraindicated. Nord[12] believed that in all hiatal hernia cases showing abdominal symptoms, phrenic nerve interruption should be tried first before contemplating radical surgery. Tallroth[13] was of the same opinion. The paralysis of the left half of the diaphragm which results from this procedure relaxes the hernial ring. The rest thus afforded the incarcerated portion of the stomach encourages the healing of erosions or ulcerations of the gastric mucosa. Nord[12] in 1929 and Tallroth[13] in 1943 each reported a case of hemorrhage from a hiatal hernia in which the bleeding ceased following phrenic nerve interruption after other measures had failed. Boyd and Classen[14] state that from their personal experience with the phrenic nerve operation it appears much more effective than the literature indicates; however, when the diaphragm is subsequently to be repaired, permanent crushing is not advocated. Welch[15] finds phrenic nerve crushing to be of value following massive hematemesis. At a later date he advocates repair of the hiatal hernia.

CLINICAL STUDY

Indications for Intervention. In four of our cases persistent severe hematemesis was the indication for intervention; in one it was so alarming that phrenic nerve interruption proved to be a life-saving procedure. This latter case has been presented in a previous report.[16] In another case marked anemia was

the indication for intervention, and in four others intense pain. The results were so gratifying that it was thought worth while once again to call attention to this method as an adjunct to other measures in complications of hiatal hernia.

TABLE I
SIGNS AND SYMPTOMS IN HIATAL HERNIA

Case No.	Presenting Complaints
I	Massive hematemesis, 1 day
II	Massive hematemesis, tarry stools, 2 days
III	Substernal pains, vomiting, tarry stools, 1 yr.
IV	Abdominal and substernal pains, 2 mo.
V	Weakness, 3 mo.
VI	Massive hematemesis, 1 day
VII	Severe vomiting, 1 day; abdominal pains, 18 yr.
VIII	Epigastric pains, vomiting, slight hematemesis, 2 yr.
IX	Massive hematemesis, 1 day

Significance of Age. Because laxity of the hiatal supporting structures progresses with advancing age, most hiatal hernias are observed in patients beyond middle age; thus when complications arise they present much more of a problem than that which would exist in a younger age group. Our nine patients ranged in ages from forty-seven to eighty-two years. Three of the patients had additional lesions in the gastrointestinal tract; one duodenal diverticula, and the other two colon diverticula, findings which have been observed by Bockus[17] and remarked upon by Huber and Andreson.[18] Diverticula and diaphragmatic hernias in the aged are the natural sequelae of increasing weakness in the muscular and connective tissue structures.[19]

Symptoms. The symptoms of hiatal hernia are manifold; however, the dominant symptoms of our patients on admission appeared to be bleeding, pain and vomiting. (Table I.)

In the four patients with hematemesis the onset was abrupt and without warning. Four other patients' collective complaints consisted of heartburn, vomiting and upper abdominal and substernal pains which had persisted for periods varying from a few months to eighteen years. At times the substernal pains were agonizing enough to be considered cardiac in origin. The symptoms in these latter four usually appeared following the evening meal, and in the main were relieved by the ingestion of baking soda or belching. There was no characteristic position that aggravated or initiated the pains. The erect or prone position made little difference. One patient felt worse lying on his right side; another, prone. Pains were relieved in one patient by bending forward, while in another this position would bring on symptoms of heartburn. One other patient's only complaint was weakness.

TABLE II
X-RAY FINDINGS IN HIATAL HERNIA

Case No.	Principal X-ray Findings
I	Moderate-sized hiatal hernia, coarse mucosal markings, short esophagus
II	One-third stomach herniated paraesophageally, normal esophagus
III	Small hiatal hernia, coarse mucosal markings, duodenal diverticulum
IV	Two-thirds stomach herniated, increased esophageal tortuosity, sigmoid diverticula
V	Two-thirds stomach herniated and flexed on self
VI	Small hiatal hernia
VII	One-third stomach herniated with hiatal ulcer
VIII	Moderate-sized hiatal hernia
IX	Moderate-sized hiatal hernia with hiatal ulcer, transverse colon diverticula

Diagnostic Procedures. In each patient the presence of a hiatal hernia was demonstrated by gastrointestinal series. (Table II.)

No ulcerations were detected within the hernial pouches except in Cases VII and IX; however, the mucosal pattern appeared coarsened in Cases I and III. All the hernias appeared to be of the sliding type, which is the usual case, except Case II which was of the paraesophageal type. The esophagus in Case I appeared shortened by x-ray studies but this was not confirmed at surgery. In the sliding type the esophagus on x-ray examination appeared shortened because of the upward elevation of the fundus, but a truly short esophagus is rare. In 111 esophageal hiatal hernia cases, using the thoracic approach, Sweet[20] found only 4.5 per cent with a short esophagus. However, in 8.4 per cent of the cases (the sliding type), many of which seemed to have a short esophagus by preoperative x-rays, a normal length esophagus was found with the fundus of the stomach herniated into

the thoracic cavity. Paraesophageal or parahiatal, as Sweet describes it because of a strand of tissue separating the hernia from the esophagus, comprised 6.3 per cent of the total. Combined types, i.e., sliding and parahiatal (paraesophageal), made up 1.8 per cent of the cases.

When indicated, other diagnostic procedures besides complete examination of the gastrointestinal tract included cholecystography, electrocardiographic studies, esophagoscopy, gastric analysis, complete blood cell counts, urinalysis, and renal and liver function tests.

Operative Procedures. By use of local anesthesia (1 per cent procaine hydrochloride) the left phrenic nerve was interrupted by crushing in seven patients and by division in two. Avulsion of the phrenic nerve was avoided, as serious complications have followed this procedure such as internal hemorrhage from tearing of the pericardiophrenic artery, a branch of the internal mammary artery, which accompanies the phrenic nerve.[21] Thorough crushing results in permanent paralysis of the left diaphragm, but should partial permanent paralysis only occur it may be sufficient to arrest the symptoms. Crushing of the phrenic nerve in these patients was found to be the most expedient and safe procedure to use in alleviating their symptoms.

Paralysis of the diaphragm produced by ordinary crushing is effective for periods varying from six to fifteen months. Permanent paralysis occurs in about 10 per cent of these patients. On the other hand avulsion and partial excision of the phrenic nerve, properly executed, always result in permanent paralysis.[22]

Results of Phrenic Nerve Interruption. In the four patients whose major complaint was hematemesis the bleeding promptly ceased and did not recur. In the other five patients whose main complaints were distressing pains and vomiting decided relief was afforded. (Table III.)

TABLE III
RESULTS OF PHRENIC NERVE INTERRUPTION

Case No.	Results	Follow-up Period
I	No further bleeding, asymptomatic	7 yr.
II	No further bleeding, asymptomatic	4 yr., 2 mo.
III	Asymptomatic	2 yr., 6 mo.
IV	Asymptomatic	2 yr., 2 mo.
V	Asymptomatic	2 yr., 1 mo.
VI	No further bleeding	1 yr.
VII	Asymptomatic, pains in left shoulder 2 wk. postoperatively	1 yr.
VIII	Decided improvement, occasional epigastric distress, weakness of left shoulder 2 mo. postoperatively	10 mo.
IX	No bleeding, asymptomatic	7 mo.

CASE REPORTS

Brief notes on nine patients seen from 1947 to 1953 are presented in order to emphasize the varied clinical patterns hiatal hernias produce and the beneficial effects, in selected cases, of phrenic nerve interruption.

Hiatal Hernia Causing Profuse, Violent, Uncontrollable Hematemesis

CASE 1. D. A., a sixty-four year old white woman, was admitted to the hospital on April 19, 1947, after having vomited blood in small amounts that same day, preceded by a three-day history of pain in the middle of her abdomen, twisting in nature, with radiation upward to the sternum. Before entry on the day of admission she had had several attacks of hematemesis followed by transient loss of consciousness. Previously she had not experienced any gastric distress. Bowel movements had been normal; no tarry stools had been noted. On physical examination deep pressure in the left upper quadrant of the abdomen produced pain in the right upper quadrant. The blood pressure was 144 mm. systolic and 88 mm. diastolic. The pulse rate was 90, the respirations 20 and the temperature 37°C. Examination of the blood showed 3.65 million red cells and a hemoglobin of 11.6 gm. (68.9 per cent). Gastrointestinal series showed a moderate-sized hiatal hernia with edema and coarsening of the mucosa but no ulceration. (Fig. 1). Cholecystography and esophagoscopy were normal. While in the hospital the patient continued to vomit large amounts of blood and passed tarry stools until on the tenth day the red cell count had fallen to 1.89 million and the hemoglobin to 5.0 gm. (29.5 per cent)—this in spite of twelve transfusions, 500 ml. each, of whole blood. On the twelfth day left phrenic nerve crushing was done under local anesthesia. Almost immediately the bleeding and vomiting ceased and did not recur. On the

FIG. 1. Case 1. Roentgenogram taken April 21, 1947, showing moderate-sized esophageal hiatal hernia.

seventeenth day the red cell count was 3.82 million and the hemoglobin 10.4 gm. (60.6 per cent). On the twenty-fourth day, May 13th, the patient was discharged in an improved condition. She entered the hospital two and a half months later, on June 29th, for repair of the hiatal hernia through a transabdominal approach. At that time the red cell count was 4.61 million and the hemoglobin level 16.9 gm. (98.2 per cent). The patient had an entirely uneventful recovery and was discharged in good health on the sixteenth postoperative day. Since that time she has been examined at regular intervals. There has been no recurrence of hematemesis, melena or pain.

Hiatal Hernia Causing Intensive Bleeding and Abdominal Pain

CASE II. M. A., a forty-seven year old white man, was admitted to the hospital on January 20, 1950, because of hematemesis, tarry stools and extreme weakness for the previous two days. Daily vomiting of bright red blood and frequent passage of tarry stools continued right up to admission time. For the past two years he had occasionally passed tarry stools and had been troubled with episodes of abdominal pains, notably after supper, which were relieved by sodium bicarbonate. He had been free of substernal pains. One year before admission, because of heartburn and belching, his doctor had ordered a gastrointestinal series which demonstrated a large hiatal hernia. Two years before he had had a cholecystectomy. He had had tuberculosis of the left lung seventeen years before, which was considered arrested. On entry the patient appeared exhausted. His skin was dry and the tongue parched. The blood pressure was 110 mm. systolic and 70 mm. diastolic. The pulse rate was 120. There were a few moist rales in the left apical area. The liver and spleen were not palpable. Laboratory studies showed the hemoglobin to be 8 gm. (46.5 per cent), the red cell count 2.8 million. Gross blood was detected in the stools. No free hydrochloric acid on gastric analysis was found. The gastrointestinal series showed one-third of the proximal portion of the stomach above the diaphragm. X-rays of the chest showed marked pleural thickening of the left chest wall and the left costophrenic angle.

During the hospital stay the patient had no further hematemesis but blood was still detected in the stools. Prior to surgery 1,000 ml. of blood were administered. On the third hospital day the hemoglobin was 10.2 gm. or 68 per cent, and the red cell count 3.29 million. On the fourth hospital day the hemoglobin was 11.9 gm. (69.2 per cent) and the red cell count 4.02 million. On the fifteenth hospital day, February 3rd, sectioning of the left phrenic nerve was done. The patient had a satisfactory postoperative course, being discharged on February 9th. Since that time the patient has had no hematemesis, tarry stools or abdominal pains. The hemoglobin and red cell counts have been normal.

Small Hiatal Hernia Causing Substernal Pains and Emesis

CASE III. J. R., a fifty-eight year old white man, was admitted to the hospital on September 16, 1951, stating that he had been troubled with attacks of vomiting and substernal pains for about a year. Vomiting usually occurred about three to four hours after the evening meal, the vomitus being free of food or blood. The substernal pains were present during much of the day but became especially sharp after a meal and while the patient rested on his right side. He tended to be constipated and occasionally noted the passage of black tarry stools. The patient had been treated from 1940 to 1945 at a Medical Center with liver injections for a condition diagnosed as pernicious anemia. When examined the patient appeared in good physical condition except for pallor of the skin.

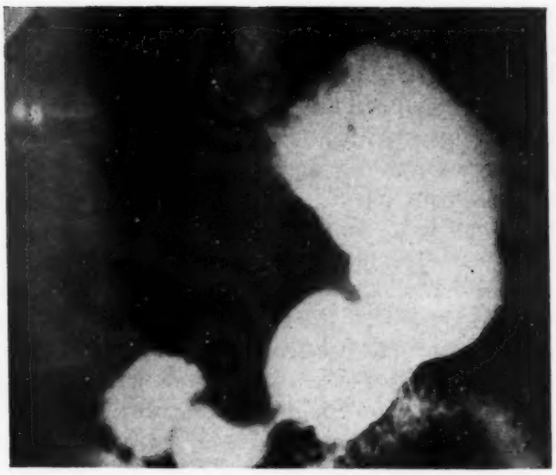

FIG. 2. Case III. Roentgenogram taken September 19, 1951, showing small esophageal hiatal hernia.

FIG. 3. Case IV. Roentgenogram taken January 11, 1952, showing large hiatal hernia with herniated portion appearing flexed on self.

Gastrointestinal series revealed a small esophageal hiatal hernia showing coarsening of the mucosa and, perhaps, a small ulcer niche. (Fig. 2.) Some duodenal diverticula were noted. The laboratory studies showed a hemoglobin of 12.0 gm. or 70.6 per cent and a red cell count of 3.69 million. No occult blood was detected in the stools. The electrocardiogram was normal. On the fifth hospital day, September 21, 1951, crushing of the left phrenic nerve was performed. The patient had a satisfactory postoperative course and was discharged on September 26th. On March 7, 1952, laboratory studies showed a hemoglobin of 15.6 gm. (88 per cent) and a color index of 0.98. Since that time the patient has had no further complaints of substernal pains or vomiting. Anemia has been absent.

Large Hiatal Hernia with Marked Abdominal and Precordial Pains

CASE IV. B. F. C., a sixty-nine year old white man, was admitted to the hospital on January 14, 1952. For the prior two months he had been troubled with upper abdominal and epigastric colicky pains which had been severe during the last month, radiating across the upper abdomen. The pains had never radiated to the back and were not related to meals. He also complained of considerable precordial pain radiating to the left shoulder area. Much of the time he felt distended. During recumbency, lying supine diminished the pains while lying prone intensified them. As a rule the colicky pains would not abate until he belched or passed flatus. At first the ingestion of sodium bicarbonate was of some benefit, but not recently. Through experience the patient discovered that massaging the abdomen, stooping and bending forward would ease the pains. One week before entry, at four in the morning, the patient experienced his worst attack which was characterized by marked upper abdominal sharp pains and dyspnea. The attack lasted one and a half hours, and was not relieved until a physician had admitted him to the hospital and given him medical treatment.

Before the present illness began the patient had been in good health without any dyspnea, cough or any type of upper abdominal or chest pains. Three years before for several months he had had moderate secondary anemia of undetermined origin. It is not known whether he had a hiatal hernia at that time. On examination of the patient following entry to the hospital there were no apparent abnormal findings and he appeared comfortable. Gastrointestinal series taken just prior to entry demonstrated a large hiatal hernia containing about two-thirds of the stomach. The hernia appeared flexed upon itself, and its contents emptied poorly in all positions. The rugal pattern of the intra-abdominal portion of the stomach appeared regular. At six hours the stomach was empty of any barium meal. (Fig. 3.) The barium enema revealed multiple large diverticula scattered throughout the colon. The red cell count and hemoglobin were normal.

On the second hospital day, January 15th, crushing of the left phrenic nerve was done under local anesthesia. On the sixth hospital

FIG. 4. Case v. Roentgenogram taken January 23, 1952, showing large esophageal hiatal hernia which appears flexed on self.

day the patient was discharged. One month following surgery repeat gastrointestinal series showed a large portion of the stomach herniated, as previously. However, when last seen twenty-six months later the patient had no further abdominal or chest pains, dyspnea or nausea. Repeat examinations of the red cell count and hemoglobin have been normal.

Large Hiatal Hernia with Weakness as Complaint

CASE V. R. M., a fifty-nine year old white woman, was admitted to the hospital on January 18, 1952, because of progressive weakness for the prior three months, manifested by easy fatigue on walking and palpitation. Her family doctor had been treating her with iron and liver for a rather severe secondary anemia during this time without any marked success. There had been no epigastric distress, nausea, vomiting, hematemesis or melena. The patient's appetite was good and she gained 10 pounds in weight during this time. About three months before admission, September 27, 1951, the patient had had a gastrointestinal series which showed a large hiatal hernia. Laboratory studies during this time revealed a falling red cell count and hemoglobin level. On November 8, 1951, the red cell count was 4.25 million and the hemoglobin level was 12.3 gm. (72 per cent). On January 7, 1952, the red cell count was 3.05 million and the hemoglobin level was 6.9 gm. (40 per cent). On examination of the patient following entry to the hospital no gross abnormalities were noted except for pallor of the skin and mucous membranes. Examination of the blood showed the red cell count to be 3.05 million and the hemoglobin level 7.7 gm. (45.4 per cent). The red cells showed marked variation in size. Stool examinations for occult blood were positive. The gastric analysis showed a small amount of free hydrochloric acid. The gastrointestinal series on January 23rd showed a large esophageal hiatal hernia displacing a distal esophagus posteriorly and toward the left, but the esophagus was not elongated and the cardia rested above the dome of the diaphragm. (Fig. 4.) The barium enema studies showed an atonic redundant colon. There was no evidence of ulceration or neoplasm of the stomach or duodenum.

Preoperatively the patient was given whole blood transfusions so that the day before surgery the red cell count was 4.76 million and the hemoglobin level was 13.0 gm. or 76.5 per cent. On the eighteenth hospital day, February 5th, the left phrenic nerve was sectioned under local anesthesia. The patient had a satisfactory postoperative period and was discharged on February 10th. The red cell count at that time was 5.43 million and the hemoglobin level was 15.6 gm. (91.8 per cent). Since surgery the patient has had no further complaints of weakness or any evidence of anemia.

Hiatal Hernia Causing Massive Hematemesis

CASE VI. A. P., a sixty-three year old white woman, was admitted to the hospital on April 2, 1953. Two hours before entry, while at home, she had begun to vomit large quantities of fresh, red clotted blood so that she momentarily lost consciousness. The past history revealed no hematemesis, melena or other gastrointestinal disturbances. On entry the red cell count was 3.41 million, the hemoglobin 9.7 gm. (56.3 per cent). That same day she was given three blood transfusions, 500 ml. each. The next day the red cell count was 3.89 million and the hemoglobin 10.2 gm. (59 per cent). A gastrointestinal series was planned for the

near future; however, on the fifth hospital day massive hematemesis recurred. The red cell count then dropped to 2.67 million and the hemoglobin to 6.6 gm. (38 per cent). That same day she was taken to surgery for abdominal exploration, which revealed only a thickening and scarring of the first portion of the duodenum. Believing this to be the source of the bleeding, a subtotal gastrectomy with an anterior anastomosis was performed. During the surgery 2,000 ml. of blood were given. The patient's postoperative condition was good until the second day when she began to vomit dark brown fluid and pass tarry stools. In order to stabilize her condition it was necessary to give 2,500 ml. of blood. The following three days the patient seemed better except for occasional vomiting of small amounts of dark greenish fluid. On the ninth postoperative day the hemoglobin was 11.3 gm. (66 per cent). On the thirteenth postoperative day a gastrointestinal series was done which revealed a hiatal hernia with possible ulcer in the herniated portion and intermittent obstruction of the efferent loop of the gastroenterostomy. On the fourteenth postoperative day a left phrenic nerve crush was done under local anesthesia. Blood, 500 ml., was given. The following day the patient continued vomiting greenish fluid but no blood. Gastrointestinal series taken at that time showed marked delay in emptying of the stomach. The patient was taken to surgery and the efferent loop was found to be patent but narrowed. To relieve this a jejunal loop was brought anteriorly and anastomosed to the anterior stomach wall. The patient had no further bleeding and was discharged on May 11, 1953. Since that time she has been in good health and has had no further bleeding.

Large Hiatal Hernia Causing Abdominal Pains and Vomiting

Case VII. M. S., an eighty-two year old white man, was admitted to the hospital on April 16, 1953. He had been sick the previous night with bouts of vomiting and upper abdominal pains. He had never vomited blood but had had left upper abdominal pains on and off for the past eighteen years. After meals he would feel bloated until relief was obtained by belching. His appetite was poor and he believed he had lost some weight. Physical examination revealed no abnormalities for a man of his age. The red cell count was 5.46 million, the hemoglobin 17.5 gm. (102 per cent). A gastrointestinal series showed a large hiatal hernia with an ulcer in the herniated portion. Because of the patient's age it was decided to crush his left phrenic nerve and observe him before attempting any major operative procedure. This was done under local anesthesia. The patient did well postoperatively and his symptoms were largely relieved. He was discharged on the seventh hospital day. His main complaint for several weeks postoperatively was pain in the left shoulder; this has since subsided. Follow-up gastrointestinal series revealed no gastric ulcer. The patient has remained entirely asymptomatic.

Hiatal Hernia Causing Upper Abdominal Pains and Vomiting

Case VIII. S. Z., a fifty-nine year old white man, was admitted to the hospital on July 8, 1953, complaining of abdominal pains and vomiting for the previous two years. The pains, dull and cramp-like, were located in the epigastric area and occurred several hours after eating. Vomiting, which was almost a daily occurrence, then followed. The vomitus usually consisted of a portion of the previous meal. Occasionally there was slight hematemesis. The pains could also be brought on by stooping over as to tie the shoe laces. Almost all foods gave him epigastric distress so that he feared eating although his appetite was good. There had been no weight loss. He had had no operations or serious illnesses in the past. Gastrointestinal series showed a hiatal hernia. The red cell count was 5.27 million, the hemoglobin 17.2 gm. (100 per cent). Physical examination was essentially negative for the stated age. On July 9th crushing of the left phrenic nerve was done under local anesthesia. The patient did well and was discharged on the fourth postoperative day. For the next two months the patient had decreased power of abduction of the left shoulder joint, but none since. The patient has been followed up since discharge. He is working regularly and has had no further vomiting. Lately he has had some burning discomfort in his epigastrium which is relieved by antispasmodics.

Hiatal Hernia Causing Massive Hematemesis

Case IX. L. I., a fifty-eight year old white woman, was admitted to the hospital on August 26, 1953. Eleven hours before admission she

was seized with a severe coughing spell, followed by the vomiting of large blood clots and coffee ground material every twenty minutes for the first two hours and then infrequently until entry. She had had spells of "indigestion" for the past four to five years, described as food seeming to stick in her stomach followed by nausea and vomiting. Heartburn after meals was common. During this period she had twice vomited small amounts of blood and several times a week she passed tarry stools. She had been admitted to the hospital two times previously for mid-abdominal pains of sixteen months' duration, diagnosed as diverticulitis of the colon. She drank one-half pint of whiskey daily. On admission the pulse rate was 100, the blood pressure 128 systolic and 68 diastolic. The physical examination was essentially normal except for obesity and slight tenderness in the right upper and lower abdominal quadrants. Laboratory studies showed a red cell count of 3.37 million and a hemoglobin of 11.5 gm. (67 per cent). On the first day the patient was given two transfusions of whole blood, 500 ml. each. The following day a gastrointestinal series showed a moderate-sized hiatal hernia with a superficial ulcer on the lesser curvature side of the herniated portion of the stomach. The transverse colon showed a number of diverticula. On August 31st the red cell count was 3.84 million and the hemoglobin was 13.1 gm. (76 per cent). On the ninth hospital day a left phrenic nerve crush was done under local anesthesia. The patient was discharged September 5th. There has been no further evidence of bleeding.

COMMENTS

Bleeding in Hiatal Hernia

Differential Diagnosis. Bleeding from the upper gastrointestinal tract has many potential sources.[23] The etiology in 640 hospitalized patients over a ten-year period at the Cincinnati General Hospital was as follows:[24] (1) peptic ulcer, 52.9 per cent; (2) undetermined, 20.6 per cent; (3) hepatic cirrhosis (ruptured esophageal varices), 12.5 per cent; (4) gastric carcinoma, 2.3 per cent; (5) hiatal hernia, 2.1 per cent; (6) gastritis and gastric erosions, 1.1 per cent; (7) ruptured aortic aneurysm, 0.8 per cent; (8) miscellaneous, 7.5 per cent.

Some of our patients presented varying pictures commensurate with esophageal varices, esophagitis, gastritis, duodenal ulcer, malignancy of the gastrointestinal tract, benign lesions as polyps or leiomyomas, diverticulitis, blood dyscrasias and other conditions that might provoke bleeding from the gastrointestinal tract. Others, in contrast, presented varying clinical pictures commensurate with duodenal or gastric ulcer, chronic cholecystitis or cardiovascular disease.

The obvious cause of massive hemorrhage is not always the true one, as is well illustrated in Case VI. In this patient a scarred and thickened duodenum appeared to be the source of the bleeding; however, subtotal gastric resection had no effect in assuaging the hemorrhage. Subsequently the bleeding was found to arise from a hiatal hernia. Hawthorne and Nemis[25] in a series of recent cases, illustrate well the baffling problems one faces in attempting to track down the sources of blood loss from the gastrointestinal tract.

Frequency of Anemia. Anemia, which is found not uncommonly in hiatal hernia patients,[26–28] had been present in six of ours (Cases I, II, III, V, VI and IX) to a rather severe degree, as manifested by the low red cell counts and hemoglobin levels. This rapidly developed in Cases I, VI and IX following violent spells of hematemesis. In the other cases the anemia appeared to be more insidious in onset and prolonged. Case III was assumed to have had pernicious anemia in 1940 and was treated five years with liver extracts. Case IV had had anemia three years before admission. In some situations bleeding may not be so evident, especially when there is no visible evidence of hematemesis or tarry stools. It has been shown that 50 to 80 cc. of blood are needed to produce a tarry stool.[29] This silent bleeding, without any accompanying gastric distress, can occur with a severe anemia developing, as illustrated in Case V in which the only complaint was increasing fatigue.

Mechanisms of Bleeding. Several explanations have been given for the mechanisms behind the bleeding in hiatal hernia. Bleeding can develop from an ulcer within or just beneath the herniated fundus,[30] or from gastritis or esophagitis brought on by inadequate drainage of the irritating peptic juices of both the stomach and esophagus.[31,32] Another explanation for the bleeding is that the vise-like effect of the diaphragmatic muscles upon the herniated stomach portion produces marked venous congestion and edema of the mucosal

layers, so that irritation of this traumatized surface by the constant to and fro motion of the diaphragm brings about bleeding erosions and ulcerations.[33–35]

Pain in Hiatal Hernia

Heartburn. The heartburn frequently complained of in hiatal hernia patients, as illustrated in four of our series, is essentially esophagitis caused by a reflex of gastric juices which are extremely irritating to the esophageal mucosa.[36,37] With a defunct cardiac mechanism existing, in the more common sliding type, the cardia ascends with ease into the chest. Thus the mere stooping forward of the patient can cause a backwash of the irritating peptic acid juices, resulting in the complaint of heartburn.

Confusion with Coronary Disease. Although some type of upper abdominal pain was experienced in all cases except Cases v and vi, it was Cases iii and iv in which precordial pains were predominant symptoms, suggesting possible coronary disease. Coronary disease was ruled out in Case iii on the basis of normal cardiac findings on physical examination and normal electrocardiographic tracings. In Case iv, although no electrocardiogram had been taken before phrenic nerve interruption, it was thought that most of the patient's complaints were on the basis of the hiatal hernia. In this instance phrenic nerve interruption proved to be an aid in the differential diagnosis from coronary disease, since following its employ the patient obtained complete relief from the severely distressing pains. This type of excruciating precordial pain has been reported upon by several authors,[20,27,38] and it is believed due in a greater degree to the constrictive or pinchcock effect upon the stomach by the spastic hiatal ring, and in a lesser degree to the distended herniated portion pressing upon the heart.[39,40] During diaphragmatic hernia repair by the thoracic approach marked constriction of the herniated stomach at the hiatus has been observed. Following the crushing of the phrenic nerve, besides the usually expected result of palsy of the left half of the diaphragm and bulging upward of the relaxed muscle, there is a disappearance of the spasm around the hiatal opening so that partial return of the herniated portion of the stomach to the abdominal cavity ensues.[31] Therefore, since in many cases the follow-up x-rays will still reveal considerable herniation, the effectiveness of the operative procedure is determined not so much by the postoperative x-ray appearance of the hiatal hernia as by the diminution or disappearance of the aggravating symptoms.

Effect upon the Heart. Not only can hiatal hernia give severe precordial pain, as already illustrated, causing confusion in the differential diagnosis from the angina pectoris of heart disease, but also it can coexist with heart disease in either a passive or aggressive role. In the latter role the dangers of gastrointestinal disorders, as hiatal hernia, to either an already diseased heart or even a normal one has been well stressed by White.[41] The hiatal hernia is capable of further jeopardizing the status of the heart by initiating reflexly extrasystoles, paroxysmal tachycardia and, at times, atrial fibrillation. By correction of this gastrointestinal disorder the heart can be relieved from this additional strain. This was accomplished in our series by phrenic nerve interruption. This correction does not justify any type of surgery which carries with it the likelihood of further damage to an already diseased heart unless this type of surgery is of absolute necessity as, for example, in strangulation obstruction where direct intervention is necessary.

Obstruction and Strangulation in Hiatal Hernia

In other complications of hiatal hernia such as obstruction, phrenic nerve interruption has been a life-saving procedure. In one such case, described by Pickhardt,[31] of an eighty-six year old woman with acute gastrointestinal obstruction, congestive heart failure interdicted any major surgical attack. Van Hazel and Jensik[27] also mentioned a similar case in which repair of the hiatal hernia was possible at a later date. According to Harrington,[11] all cases associated with colon or small bowel in the hernia should have early surgery because of the imminent danger of bowel obstruction. One must also be alert to the possibility of hiatal hernia of the stomach strangulating. In these immediate surgery is imperative, as gangrene of the stomach wall ensues.[42]

SUMMARY AND CONCLUSIONS

Esophageal hiatal hernia can produce numerous clinical symptoms mimicking those of widely divergent diseases. It can cause grave complications like massive hemorrhage, protracted vomiting or sharp precordial pain. Clinical studies of nine cases illustrating these

complications and the merits of phrenic nerve interruption in each have been presented. The historical background for phrenic nerve interruption in the hiatal hernia has been traced back to 1906. The opinions of several authorities regarding the benefits of this procedure in complicated hiatal hernias have been summarized. The complications of bleeding, pain and obstruction in hiatal hernia as regards differential diagnosis and mechanics have been discussed. The indications for phrenic nerve interruption in the complications of esophageal hiatal hernia and the merits derived therefrom have been presented.

In conclusion, it is believed that phrenic nerve interruption is definitely indicated in those hiatal hernia cases evidencing massive hematemesis in order to control the hemorrhage until such time that definitive surgery can be performed. In those cases with marked upper abdominal and precordial pains it is believed that it is indicated, not only in relieving the pains but also in decreasing the stress reflexly imposed upon either a normal or a diseased heart. It is also thought to be of great value in clarifying the differential diagnosis between hiatal hernia and heart disease. Finally, in the aged in whom major surgical attack upon the hiatal hernia is precluded but who suffer from pain, bleeding or vomiting, phrenic nerve interruption produces dramatic relief with minimal risk involved in the procedure. In any event phrenic nerve interruption allows the surgeon a precious interlude in his further management of the esophageal hiatal hernia complications.

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A child biting on an inflated inner tube may sustain a rupture of the esophagus. In such instances conservative therapy usually suffices. An intragastric tube is invariably indicated plus antibiotic and supportive therapy. Even a gastrostomy is occasionally needed but direct surgery on the esophagus ruptured by compressed air can usually be avoided; nature is apt to heal the tear very adequately, even though slowly. (*Richard A. Leonardo, M.D.*)

Abnormal Vaginal Bleeding

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ABNORMAL vaginal bleeding is one of the most common gynecologic symptoms presented to the practitioner either on the patient's own complaint or in routine history-taking. From our joint experience in office and clinical practice with women in whom abnormal vaginal bleeding was a presenting complaint, we have evolved a simplified office routine by means of which the vast majority of such patients can be simply, efficiently and successfully managed in the physician's office without recourse to consultations.

TABLE 1*

ABNORMAL VAGINAL BLEEDING

(A SIMPLIFIED TABLE OF CAUSES FOR USE IN RAPID DIFFERENTIAL DIAGNOSIS)

I. Functional bleeding of endocrine origin:
   - A. Estrogen withdrawal
   - B. Spontaneous
   - C. Ovulatory

II. Organic causes:
   - A. Complications of pregnancy
     1. Abortion
     2. Ectopic pregnancy
   - B. Inflammations of the genital tract
     1. Senile vaginitis
     2. Pelvic inflammatory disease
     3. Erosion and endocervicitis
   - C. Benign tumors
     1. Cervical or endometrial polyp
     2. Fibroids, adenomyosis, myometrial hyperplasia
     3. Endometriosis
     4. Ovarian cysts and tumors
   - D. Malignant disease
     1. Carcinoma of the cervix or endometrium
     2. Carcinoma of the ovary or tube
   - E. Systemic disease
     1. Blood dyscrasias, especially purpura hemorrhagica and leukemia
     2. Severe hypertension and cardiac failure

* Modified from Taylor and Millen.[1]

We have extensively reviewed the literature on abnormal bleeding. Our own recommendations for simplified office treatment of abnormal vaginal bleeding conform in general with the consensus of the most expert and advanced specialized practices in gynecology. We have especially noted herein the few diagnostic and therapeutic procedures which should be attempted only by the experienced gynecologist.

DIFFERENTIAL DIAGNOSIS

We wish to call attention to Table 1 for the quick differential diagnosis of abnormal vaginal bleeding. As a first precaution in the use of this table, it must be assumed that abnormal bleeding from the vagina is indeed *vaginal* bleeding. Blood coming from the urethra or rectum is sometimes mistaken for vaginal bleeding by the patient. Vaginal bleeding can be positively differentiated by having the patient insert a tampon in the vagina for twenty-four hours.

Abnormal vaginal bleeding may appear as (1) profuse or prolonged menstrual periods (menorrhagia), (2) unexpected bleeding between periods (metrorrhagia) or (3) bleeding after the menopause. Metrorrhagia and postmenopausal bleeding may be an early sign of genital cancer.

Etiology. Abnormal vaginal bleeding has either an endocrine or an organic basis. Organic causes, obviously, must be ruled out before any therapy is instituted.

Functional bleeding of endocrine origin may be caused by estrogen withdrawal, it may be quite spontaneous, or it may be related to ovulation.

The organic causes of abnormal bleeding include complications of pregnancy, inflammations of the genital tract, benign and malignant tumors, and certain diseases of the blood-forming and circulatory systems.

The complications of pregnancy which can be responsible for abnormal bleeding are principally abortion and ectopic pregnancy, less often placental polyps, and very rarely hydatidiform moles and chorioepithelioma.

The inflammations of the female genital tract which may give rise to abnormal bleeding are senile vaginitis, pelvic inflammatory dis-

ease, erosion and endocervicitis, and decubitus ulcers from uterine prolapse.

Benign tumors that may be manifested by abnormal vaginal bleeding are cervical or endometrial polyps, fibroids, adenomyosis, myometrial hyperplasia, endometriosis and ovarian cysts or tumors.

Malignancies evoking genital bleeding are, in order of frequency, carcinoma of the cervix, carcinoma of the ovary and carcinoma of the endometrium.

The systemic diseases to be particularly considered in the presence of abnormal vaginal bleeding are blood dyscrasias, especially purpura hemorrhagica and leukemia, severe hypertension and cardiac failure.

DIAGNOSTIC PROCEDURES

The step by step diagnostic procedures in the presence of abnormal vaginal bleeding may be simplified by taking them in the following order: general physical examination, paying special attention to the cardiovascular system and the presence of hypertension and anemia; gynecologic examination; dilatation and curettage; and hysterography.

Gynecologic Examination. Insert an unlubricated bivalve speculum and carefully visualize the vagina and cervix. Obtain Papanicolaou smears[2,3] from the vaginal pool and cervix. The smears may be discarded if a probable cause is subsequently found. Then perform bimanual and rectal examinations. After completing the bimanual examinations, obtain a biopsy[4] specimen of any suspicious lesion of the cervix. The use of Schiller's test helps single out abnormal areas of the cervix for biopsy.[4]

Dilatation and Curettage. In the absence of palpable organic disease dilatation and curettage should be considered. This is desirable for both diagnosis and therapy. In practice it may be difficult to curet all patients with abnormal bleeding; yet important endometrial disease can be missed if this procedure is omitted. To strike a workable balance, the following management is recommended:

All cases of postmenopausal bleeding not due to an obvious local cause, e.g., senile vaginitis, should be curetted. In menopausal or postmenopausal women who have recently received estrogens curettage may be deferred. It is essential, however, in recurrent bleeding.

Patients with bleeding between periods should be curetted unless a probable cause is found such as cervical polyp or bleeding erosion. If bleeding recurs after treatment, curettage is necessary.

Curettage may temporarily be omitted in adolescent and young unmarried women when functional bleeding is strongly suspected after thorough examination. Excessive bleeding in the adolescent is almost always of functional origin.

When curettage is impractical for any reason or if it is refused by the patient, obtain vaginal smears to help rule out carcinoma of the cervix or endometrium. Intrauterine aspiration smears have been suggested for this purpose.[5] The finding of malignant-looking cells necessitates both curettage and biopsy of the cervix.

Hysterography. In the management of abnormal bleeding, hysterography is specifically indicated in those cases in which bleeding recurs after curettage, to exclude small submucous fibroids and polyps which may have been missed on dilatation and curettage. In this sense the two procedures are really supplemental.

Hysterography[6] will often reveal the presence of submucous tumors, endometrial hyperplasia, adenomyosis, genital tuberculosis[7] and unsuspected adnexal disease.[8] The extra cost to the patient of this x-ray procedure should be considered and contraindications to it kept in mind. Hysterography is contraindicated in pelvic inflammatory disease, when the sedimentation rate is elevated and while active uterine bleeding is present.

Endometrial Biopsy. In sterility associated with abnormal bleeding, endometrial biopsy at the time of the expected period is helpful in revealing whether or not ovulation has occurred. However, such biopsy cannot be relied upon to exclude organic disease.

TREATMENT OF FUNCTIONAL BLEEDING OF ENDOCRINE ORIGIN

Estrogen Withdrawal. A frequent cause of abnormal bleeding is the therapeutic use of estrogens for menopausal symptoms. Such bleeding generally follows within two weeks after estrogen "withdrawal." This has greatly contributed to the number of cases of "functional bleeding" seen today. For this reason all patients with menopausal or postmenopausal bleeding must be specifically questioned about hormone therapy.

A less commonly used hormone, progesterone, can also cause withdrawal bleeding. This principle has been used by Albright[9] and modified by Greenblatt[10] to produce a medical curettage. Shedding of the endometrium is expected within three days of cessation of therapy. The patient should be warned of possible excessive bleeding.

The discontinuance of estrogens results in the cure of estrogen withdrawal bleeding. Recurrent staining, however, is no longer classified as "withdrawal" bleeding and curettage is essential.

Ovulatory Staining. Spotting may occur for a day or so at the time of ovulation, usually two weeks before a menstrual period. If consistently limited in this way, such staining is physiologic and requires no treatment.

Spontaneous Bleeding. This is a diagnosis made by excluding organic disease. Such functional bleeding is associated with any type of endometrium. In our opinion, specific therapy based upon the type of endometrium has not given superior results. Greenblatt[10] holds an opposite view.

Constitutional Factors. In all patients with spontaneous functional bleeding improvement in general health and correction of malnutrition[11] or obesity are desirable.

Thyroid. Given empirically, thyroid is often of value although no immediate effect upon the bleeding is expected. The dosage, in office practice, is regulated according to the pulse rate, the basal metabolic rate and the fasting blood cholesterol.

*Ovarian Hormones.** The cyclic oral administration of estrogen and progesterone as advocated by Hamblen[12] is generally effective if bleeding is not profuse. Estrogen may be used alone, omitting progesterone. Progesterone has also been used alone, particularly for the control of adolescent menorrhagia.[13]

One tablet of ethinyl estradiol (.02 mg.) is given three times daily for twenty days. It is combined with oral progesterone, 10 mg., three times daily during the last ten days of estrogen therapy.

Within a week after therapy is discontinued there is uterine bleeding in moderate amount. On the second day of bleeding cyclic therapy is again begun and continued thus for four consecutive cycles.

Give much larger amounts of estrogen for rapid hemostasis if bleeding is profuse, e.g., ethinyl estradiol, 0.5 mg., every hour until under control. Stilbestrol is readily available in 25 mg. tablets but has the disadvantage of causing more nausea. Recently Greenblatt[14] has suggested intravenous estrone sulfate.

The dosage of estrogens is gradually diminished until the dose is 0.02 mg. of ethinyl estradiol daily. Sudden change in estrogen level results in hemorrhage. Cyclic oral administration of estrogen and progesterone as stated heretofore is then continued.

Testosterone (male sex hormone) is possibly the simplest and most effective drug to control functional bleeding. It is particularly valuable in menorrhagia associated with small fibroids, adenomyosis and endometriosis. Side effects of virilization are relatively rare and, if recognized early, rapidly disappear with discontinuance of therapy.

The unpopularity of androgen is due chiefly to the fear of masculinization.[16] Acne, hirsutism or hoarseness are the earliest signs of virilization and may occur even with small doses in sensitive individuals. Treatment should be stopped if these signs appear. Fortunately such side effects are rare. A common side effect of testosterone is increased libido.

Testosterone may be used in varied ways. Two effective schedules which employ relatively small doses are as follows: (1) methyltestosterone, 25 mg. daily by mouth, during the last ten days of the menstrual cycle, or (2) methyltestosterone, 25 mg. daily by mouth for six days preceding the estimated day of ovulation (e.g., from seventh day to thirteenth day in the usual twenty-eight-day cycle).

For severe bleeding testosterone propionate is given intramuscularly in doses of 50 to 100 mg. daily for two to three days. The choice between large doses of testosterone or estrogen in such cases is one of individual preference.

At the present time treatment with gonadotrophic hormones is disappointing.[17] Toluidine blue[18] and vitamin P are under current investigation. Low dosage irradiation to the pituitary and ovaries,[19] or wedge resection of the ovaries[20,21] may be considered in the treatment of abnormal bleeding associated with anovulatory cycles and sterility. As a last

* The hormonal preparations were contributed by Chas. Pfizer & Co., Inc., Brooklyn, N. Y., as estrogen (diogyn-E), progesterone (syngestrotabs®) and androgen (synandrotabs®).

resort castration-dose irradiation or hysterectomy may be necessary.

The hormonal control of uterine bleeding is unquestioned, but emotional and psychogenic factors effect the functions of the endocrine glands.[22] Therefore whatever therapy is used, reassurance and freedom from emotional stress should be sought.

TREATMENT OF ABNORMAL VAGINAL BLEEDING OF ORGANIC CAUSE

Complications of Pregnancy. Bleeding in early pregnancy is frequent. Most cases of threatened or incomplete abortion are easily diagnosed by the history of a missed period and signs of early pregnancy. Errors occur when the history is misleading or inaccurate.

Threatened Abortion. The primary symptom of threatened abortion is bleeding, with or without lower abdominal cramps. There is no cervical dilation or passage of tissue as in incomplete abortion. When the passage of tissue is questionable, the case is best considered a threatened rather than an incomplete abortion. Any aborted tissue may be preserved in 10 per cent formalin for examination.

Many miscarriages have been found to be due to an abnormal conceptus.[23] At the present time there is no way to distinguish this group of patients, in whom all therapy must necessarily fail.

Bedrest is desirable for all patients with threatened abortion. Sedation in the form of phenobarbital, ½ gr. three times daily, or demerol,® 100 mg. orally every four hours, may be given for pain if required. Constipation may be avoided by a gentle laxative such as mineral oil or milk of magnesia.

Endocrine Therapy. Progesterone in daily doses of 75 to 100 mg. intramuscularly has been shown to be of value in certain cases. Its empiric use, cost permitting, is therefore advisable. Guterman,[24] by means of pregnandiol determinations, has been able to predict the usefulness of such therapy, but these assays are not generally available.

Thyroid, 1 gr. daily, is also given empirically.

Estrogenic hormone therapy* has been widely employed but we are not convinced of its value. Missed abortion seems to be more frequent after estrogen therapy.

Incomplete Abortion. In these cases some tissue is passed and the cervix is usually open. Most cases of incomplete abortion can be treated conservatively with 1/320 gr. tablets of ergotrate or methergine® four times daily. Either ergonovine[25] or methergine may be used as they do not produce ergotism in humans.

Curettage should be done if bleeding continues for two weeks; sooner if bleeding is profuse. In our opinion the most expeditious treatment of incomplete abortion is by early curettage in order to avoid the uncertain outcome of conservative therapy.[26] Hemoglobin values are helpful to determine the degree of anemia present.

Ectopic pregnancy causes abnormal bleeding and is frequently overlooked as a cause of unexpected vaginal bleeding in women of the childbearing age. It constitutes a difficult diagnostic problem because of its varied symptoms and is often confused with functional bleeding.

Once a diagnosis is established, prompt surgery is indicated. Because of the difficulty in establishing a diagnosis, cul-de-sac puncture with a needle,[28] culdoscopy[29] and exploratory colpotomy[30] have been advised. These procedures should be reserved for the experienced gynecologist.

Hydatidiform mole and chorioepithelioma are rare complications of pregnancy.[31]

Placental polyp may persist even for months after delivery and be overlooked in the differential diagnosis.

Senile (Atrophic) Vaginitis. Atrophic vaginitis produces staining usually after the menopause. Small fissures and bleeding spots are generally noted on the mucosa. Diagnosis is made on wet saline smear which characteristically shows basal "atrophy" cells, as well as many pus cells. Papanicolaou vaginal smears should also be made to help rule out uterine malignancy.

Treatment consists of inserting an estrogen suppository such as amniotin® 2,000 I.U. or stilbestrol 0.5 mg. into the vagina each night for two weeks, then less frequently as needed. The oral or parenteral administration of estrogens is not advised for senile vaginitis because of the greater tendency to produce uterine bleeding.

Occasionally severe vaginitis of other origin, e.g., trichomoniasis, causes spotting.

* Smith[27] advocates the following plan: stilbestrol, 5 mg. daily by mouth, the daily dose to be increased by 5 mg. at two-week intervals up to the fifteenth week when at least 25 mg. daily are taken. Thereafter, the daily dose is increased by 5 mg. at weekly intervals. Therapy is discontinued after thirty-six weeks of gestation.

Pelvic Inflammatory Disease. This commonly produces irregular uterine bleeding, apparently due to co-existing ovarian dysfunction. Diagnosis is made on history and physical examination. An asymptomatic, "burnt-out" salpingitis with few physical signs and a normal sedimentation rate may sometimes be unexpectedly revealed by hysterosalpingography.[8]

When bleeding is the chief symptom, the hormonal therapy used for the treatment of functional bleeding, outlined heretofore, is helpful. Persistent bleeding eventually requires surgery.

Cervical erosion, endocervicitis and cervical polyps may cause staining, particularly after douching or coitus. Diagnosis is readily made on visualization of the cervix.

Erosion and *endocervicitis* are best treated by radial cauterization with the nasal tip cautery. The most serious complications are stricture of the cervical canal and hemorrhage as a result of too energetic treatment. These sequelae are rare when a fine nasal tip cautery is properly used.

For severe bleeding, which occurs ten to fourteen days after therapy, place a strip of oxycel gauze or an applicator dipped in negatan® solution directly against the bleeding point and maintain pressure for several minutes.

For stricture the cervix should be sounded and, if necessary, dilated every three months for one year.

Remove a *cervical polyp* by grasping its base with a ring forceps and twisting it with a continuous rotary motion of the hand.

All polyps should be examined microscopically. Cervical polyps are almost always benign, but occasionally carcinoma of the endometrium presents itself in polypoid form resembling a cervical polyp.

Endometrial polyps are frequently asymptomatic but may cause either menorrhagia or metrorrhagia. Diagnosis is best made on hysterography. Treatment is by curettage.

Fibroids. Small fibroids may be treated with testosterone as outlined heretofore for the treatment of functional bleeding.

Pregnancy excluded, the most common causes of smooth symmetric enlargement of the uterus associated with abnormal bleeding are submucous fibroid, adenomyosis and myometrial hyperplasia.[33] These conditions may also be treated with hormones. The co-existence of uterine carcinoma with benign neoplasms of the uterus should not be overlooked.

Endometriosis. The characteristic triad of symptoms are progressive dysmenorrhea, sterility and abnormal bleeding, yet the diagnosis is obscure in atypical cases.

For bleeding during the child-bearing age, the treatment is similar to that of functional bleeding, chiefly with the use of testosterone. Karnaky[34] has suggested a variation in endocrine therapy utilizing large doses of stilbestrol to inhibit menstruation for six months.

In older women the definitive therapy is panhysterectomy. Bleeding associated with long-standing infertility or intractable dysmenorrhea may require conservative surgery, such as ovarian resection and uterine suspension, if trials with hormone therapy are unsuccessful.

Ovarian Cysts or Tumors. Any ovarian cyst or tumor, regardless of endocrine function, may cause bleeding. Ovarian enlargement of less than 5 cm. is generally due to simple cystic disease. When it is associated with abnormal bleeding, the treatment is the same as for functional bleeding.

Resection of the ovaries for polycystic disease is not recommended by us except as a last resort. However, any persistent ovarian enlargement over 7 to 10 cm. warrants laparotomy even in the absence of symptoms.

Carcinoma of the genital organs must always be excluded as a cause of abnormal bleeding at any age. Careful pelvic examination, vaginal smears, biopsy of the cervix, and curettage of the endometrium and cervix are essential aids in ruling out a suspected malignancy.

Blood dyscrasias[35] may manifest themselves by vaginal bleeding, occasionally as the first or chief symptom. Similarly, hypertensive disease and cardiac failure may be associated with intermittent bleeding.

SUMMARY

The office management of abnormal bleeding is greatly simplified by an orderly search for its cause—functional or organic. Many of the cases are readily managed in office practice by rational therapy, properly prescribed.

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A Follow-up of the Early Operation for Myelocele and Meningomyelocele on Ten Unselected Cases

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IN October, 1950, the author published[14] a report on the operations in ten unselected cases of spina bifida. Most of these cases were

FIG. 1. Case I, baby A.

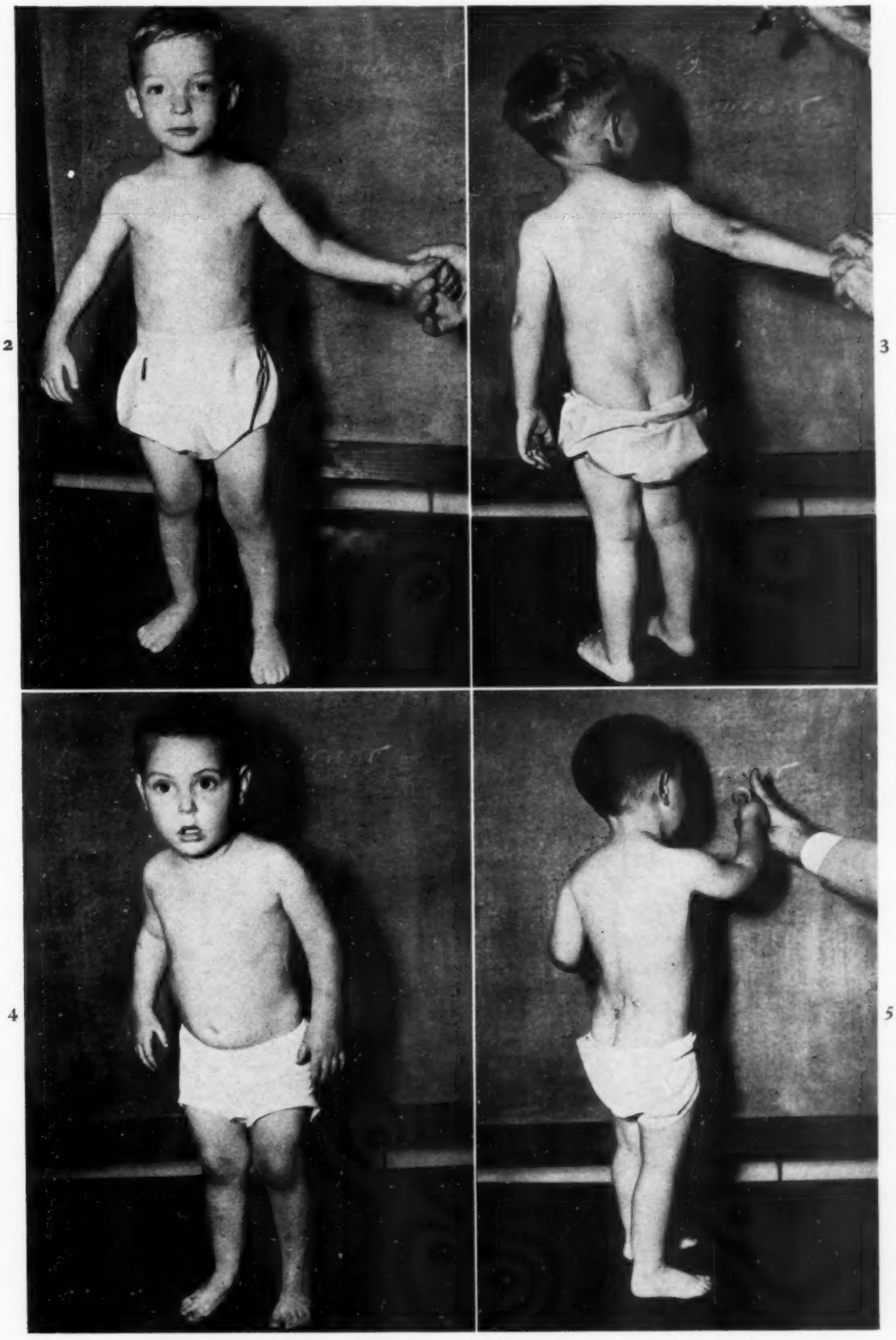
of such a nature that there was a question as to whether or not they would have been recommended for surgery by ordinary criteria. It was not intended to establish a policy of operation without due regard to neurologic deficit and the likelihood of success, but rather to salvage what we could and to learn whether or not the criteria which have been generally accepted for operation in the past might not be too strict. It was also desired to test whether very early operation might not have advantages over a long waiting period such as that advocated by Campbell.[1] The immediate results were most encouraging, and the follow-up results to be reported herein are such that, in the words of Edgerton, "A strong mood of optimism is warranted today."[2] Seven of these children are living today. Two eventually died of hydrocephalus and one of enteritis. There were no deaths attributable to surgery.

CASE I. Baby A. had a wide-based meningomyelocele, lumbar and sacral, 10 cm. in diameter, with a parchment-like sac. She had a hydrocephalic facies and a tense fontanel. She was operated upon two days after birth. The hydrocephalus became arrested and remained so up until the time she was last seen at about eighteen months of age. Figure 1 is a picture of the patient at that time. She was lost to follow-up when she was two and a half years old, but at that time she was able to walk and talk and appeared to be developing normally. Her only difficulty was the necessity of an enema each morning because of stubborn constipation.

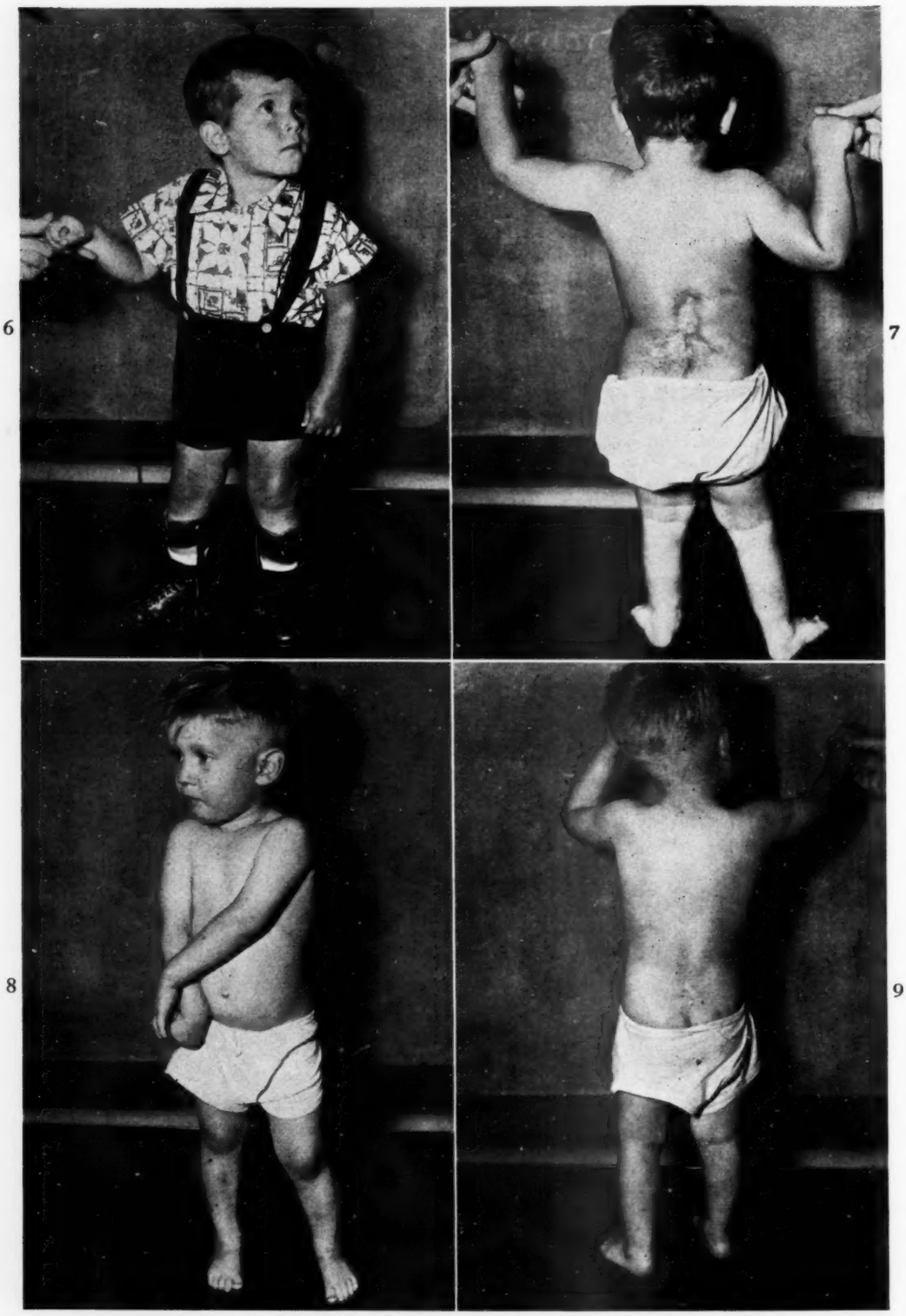
CASE II. Baby Lig. had a lumbar meningomyelocele the size of a silver dollar. At three years of age he was bright, alert and had developed normally except for mild urinary incontinence. (Figs. 2 and 3.)

CASE III. Baby L. E. had a very large meningomyelocele 8 cm. in diameter in the lumbosacral area, which was operated upon twenty-four hours after birth. Two and a half years postoperatively he had developed normally, walking and talking with a skill usual for his age; he had good bowel and bladder control. His appearance is shown in Figures 4 and 5.

CASE IV. Baby T. had a saucer-sized lumbar meningomyelocele with a parchment-like covering. He also had bilateral clubbed feet. He was operated upon the fifth day after birth. The wound became infected, and on the tenth day postoperatively a definite tendency toward hydrocephalus was plainly evident. Reoperation discovered an annular band constricting the cord just above the defect. When this was cut, the evidences of hydrocephalus receded. Two and a half years postoperatively he was walking well with braces but was still having difficulty with control of bladder and bowel. His mental development was normal for his



FIGS. 2 and 3. Case II, baby Lig. FIGS. 4 and 5. Case III, baby L. E.



Figs. 6 and 7. Case IV, baby T. Figs. 8 and 9. Case V, baby S.

age. Figures 6 and 7 show his appearance at that time.

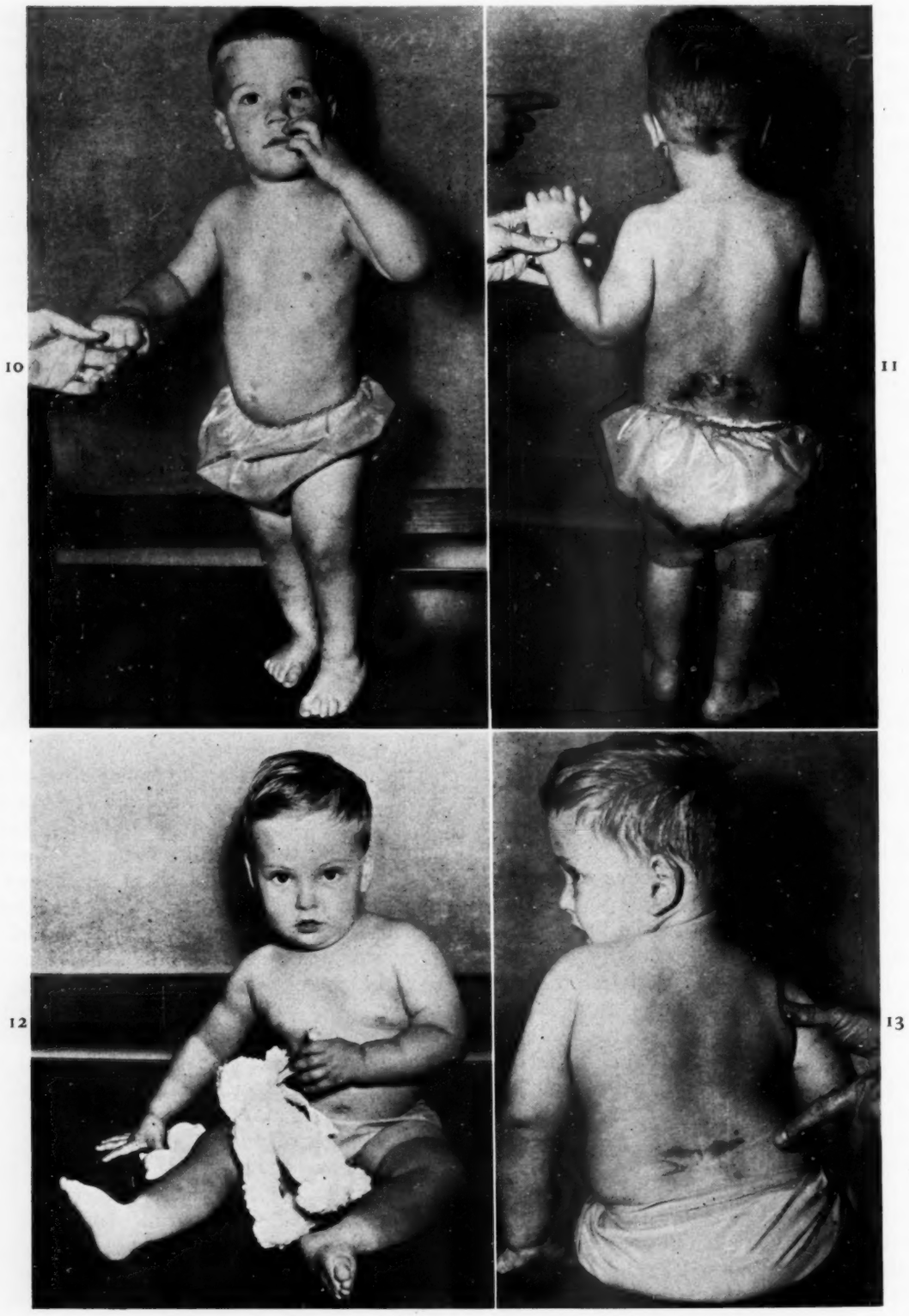
CASE V. Baby S. had a small defect, a myelocele in which a large meaty filum terminale was found attached to the very center of the sac. It was operated upon one week after birth. At three years of age (Figs. 8 and 9) the patient was developing normally in every respect and had no incontinence or signs of hydrocephalus.

CASE VI. Baby G. had a meningomyelocele 7½ cm. in diameter and lumbar in position with a parchment-like dome. He was operated upon within the first twenty-four hours of life. His appearance at three years of age is shown in Figures 10 and 11. At this time his development was completely normal except for occasional urinary incontinence. It is to be noted that the skin over the spina bifida in spite of operation shows a hirsute appearance.

CASE VII. Baby C. had a directly exposed cord and cauda equina without a covering sac. The child did not move his legs before operation and the sphincters were questionable. At two years of age his appearance was as shown in Figures 12 and 13. At this time he could crawl but not walk; he had poor bladder control but good bowel control; he was of excellent mental development. We have had a further report on him in the past year. He is now going to a school for crippled children, wearing long leg braces and is doing very well. His sphincter control has improved.

In comparison to the results of cases reported by Frazier[3] in 1918 that "severe spina bifida is 81% fatal if not operated in the first year of life," these results might be considered something of an improvement. Voris[4] states with good reason that spina bifida is the most common congenital defect of neurosurgical importance in infants. Owens[5] mentions that spina bifida is estimated to occur in about one of every 1,000 newborn infants. Several clinics have been able to amass a considerable series for reporting in the literature; Ingraham[6] in a study of 546 cases and the Mayo Clinic in an even larger study of 570 cases.[7] Schwidde[8] has been able to amass a survey of 225 cases. While these series contained a small number of cases of cranium bifidum, the large majority were those of spina bifida; and it can easily be seen that the problem is a considerable one, deserving of attention and effort on the part of the medical profession.

Ingraham,[6] Campbell,[1] and Jaeger[9] have advocated in most cases a rather long waiting period. Ingraham[6] and Hamlin,[10] however, do state: "In some cases, the membrane may be so thin and fragile that operation must be carried out immediately to avoid rupture and subsequent meningitis." Edgerton[2] points out that the treatment of clubfoot and other orthopedic deformities may have to wait until firm closure of the vertebral defect has been accomplished. He believes that this is an additional reason for seeking an early repair. Still a further consideration is the discovery by Bucy and others of tiny dermal sinuses which lead directly from the skin to the neural canal and are open avenues for the access of infection. Bassett[11] points out that congenital lipomas may be present which may produce serious neurologic deficits if not treated early in life. In the thinly covered spina bifida, infection is a real danger in the average hospital. A parchment sac can be considered practically no insurance at all against bacterial invasion of the nervous system. Dr. A. Earl Walker of Johns Hopkins University, in doing a great many autopsies, found that cases of hydrocephalus caused by low grade infection of the central nervous system are far more common than those secondary to the Arnold-Chiari complex (personal communication). Resistance to infection is said classically to depend on three things: first, the virility of the host; second, the general natural and acquired immunity; and third, local immunity inherent in an intact epidermis. In these infants we can expect to have less than the normal virility because of their poor development and because they are weak newborns. Natural immunity may be present, but acquired immunity certainly is not yet developed. The integrity of the integument has been broken by the presence of a parchment sac or of a dural sinus leading directly to the subarachnoid space. In such cases even our present effective antibiotics can hardly be expected to protect such infants from the myriad of virulent germs about us. I have had the experience of seeing one infant in the first day of life, with a meningomyelocele with parchment sac, who moved both lower extremities vigorously and controlled his sphincters, and of having to postpone the operation for two weeks because of lack of operating room space. It was my misfortune, in spite of all precautions, to see a low grade infection start in this child with hyperthermia.



Figs. 10 and 11. Case VI, baby G. Figs. 12 and 13. Case VII, baby C.

It was possible to watch the onset and progression of neurologic deficits directly parallel the infection. By the time the child was brought to operation it moved neither lower extremity nor did it control either sphincter. In addition to this, a bulging fontanel attested to the onset of the early signs of hydrocephalus. It is the author's belief that unless one can be absolutely sure of the intactness of the integument, it is better to operate in the first twenty-four hours of life to prevent infection than to combat it later.

Schwidde[8] reports a mortality of only 8 per cent, which is in marked contrast to the high percentage of mortality presented by the advocates of later operation. Warthen, LoPreste and Burdich[13] state: "It is our contention that surgical removal of the sac should be accomplished shortly after birth in those cases in which thin atrophic skin covers the sac." Dr. W. B. Scoville, in a personal communication, states: "It is my belief that operation should be done as soon as possible if the meningocele is leaking or oozing."

While authors seem to be divided on the subject as to whether early operation should be undertaken in these cases, there is more agreement on which cases should be submitted to operation. Control of the sphincters appears to be a matter of prime importance. It is difficult to ascertain whether a child one or two days old can control its sphincters; however, by observing him carefully when he cries and when held up in a vertical position, one can get some idea as to whether urinary incontinence is present. Insertion of the tip of the little finger into the rectum, pricking the perianal area with a pin, and other simple tests will give some evidence as to the integrity of the anal sphincter. I believe it is the conviction of most students of this subject that if the sphincters are definitely impaired, operation should be undertaken only under rare circumstances.

Paralysis is less of an indication for withholding the operation than sphincter incontinence. It is absurd to do everything possible to save a badly paralyzed polio patient on the one hand, and withold medical skill from a paralyzed spina bifida case on the other. The decision here should wait upon the wishes of the parents who have been well informed as to the outlook, and on the judgment of the operating surgeon.

Strangely enough, even the most conservative authors have been among those who have stated that early evidence of hydrocephalus is no contraindication to repair of the meningomyelocele. This has been in part due to the fact that, as is stated by Ingraham and Swan,[6] "Examples have been seen of patients operated on in the presence of increasing hydrocephalus who became arrested and developed normal mentality." Fisher, Uihlein and Keith[7] found seven cases of hydrocephalus which had become arrested in this manner. In addition to this consideration it must be noted that the surgical treatment of hydrocephalus is rapidly developing. From abroad comes the testimony of Truelsen.[12] "We do not find the risk of hydrocephalus to be any contraindication to operation of meningocele." Edgerton[2] states that "Here at Johns Hopkins, the neurosurgeons feel that hydrocephalus will develop without regard to operation and that one is not justified in withholding operation for that reason alone."

In addition to other reasons for early operation the author would like to call attention to a finding reported in his original article in this Journal[14] in which in some cases an annular constricting band was found beneath the lamina, immediately cephalad to the defect. This band appeared to constrict the spinal cord in such a manner that the bulbous anomalous end could not rise in the spinal canal with growth, thus promoting the Arnold-Chiari complex. Dr. Robert Heimburger of the Indiana University Medical Center has confirmed the finding of such a band in his department (personal communication), and Dr. George C. Garceau[15] in an article describing progressive neurologic deficits in connection with spina bifida describes his Case III as follows: "A laminectomy of the fifth lumbar and first sacral vertebrae was performed. A mild spina bifida was found. The ligamentum flavum appeared to constrict the dural sac. Two small dural bands stretching across the dura at the fifth lumbar level were severed." In such cases as this where a band may be present, hydrocephalus is to be expected if the constriction is not cut. The large percentage of hydrocephalus developing in the series of cases reported by those who advocate the long waiting period may possibly be due to such factors as low grade infections of the nervous system and such constricting bands as are described here.

SUMMARY

A follow-up on ten unselected cases of myelocele and meningomyelocele treated by early operation has been given. Although most of the cases were of the type that might have been refused surgery according to well accepted criteria, the results have been encouraging. Early operation has been advocated for all cases in which infection is a real danger because of a thin covering or because of the possibility of the presence of a dural sinus. A second consideration is the finding by several authors of factors which would promote progressive neurologic deficit later if not found and removed at early operation, such as constricting bands, lipomas and hypertrophied filum terminale. It is pointed out that the possibility of a developing hydrocephalus is, now, not considered by many as a contraindication to operation. An intelligent and aggressive attack upon a problem which recurs in one of every 1,000 births solicits the attention of the medical profession.

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Etiologic Role of Trauma in Nephroptosis

INDICATIONS FOR NEPHROPEXY

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From the Department of Urology, St. Mary's Hospital, San Francisco, Calif. Presented at the Spring Meeting of Northern California Chapter, American College of Surgeons, March 13, 1954, San Francisco, Calif.

DURING the past thirty-eight years I have developed great interest in the relation of trauma to nephroptosis and hydronephrosis. In 1925 my first detailed work was published on movable kidney in which the etiology, pathology, symptomatology, diagnosis and treatment were discussed. In 1930 and 1937 I published papers dealing specifically with the role of trauma in the production of nephroptosis and hydronephrosis. There is little in the recent literature on this subject.

The question of the etiology of trauma is of great importance as people are wont to attribute their troubles and distress to injury, particularly when there is a question of monetary compensation. Therefore the attending physician must make a careful evaluation of each case to determine if the ptosis or hydronephrosis in question actually resulted from injury.

Intensive study has revealed the existence of certain mechanical factors which must be present to produce ptosis of the kidney. These include the erect position of man, peculiarity of body form (in which renal fossa containing the kidney varies in shape), lack of muscle tone, diminished intra-abdominal pressure, inherent weakness of the supporting renal and perirenal fascias, etc. Trauma may cause descent of the kidney in patients of peculiar body form in whom the renal fossa offers poor support. However, it may occur in people with so-called normal anatomic configuration. Although infrequent, increased weight of the kidney (due to tumor, cystic disease, calculi or hydronephrosis) has also been given as a cause of movable kidney. In these, superimposed infection is often present and accompanying perinephritis tends to fix the kidney in place, preventing even normal mobility.

Usually the kidney extends from the eleventh dorsal to the third lumbar vertebra, although position of the kidney varies considerably. In making routine retrograde pyelograms I have carefully observed the position of kidneys in the Trendelenburg, horizontal and erect positions, and noted considerable variation of location and excursion. Buedinger measured the kidney position in sixty autopsies and called attention to this variation. Moody and Van Nuys made a roentgenographic study of 225 healthy men and women students at the University of California and found that the most common location of the kidneys in the erect position is opposite the first four lumbar vertebrae; in the supine position, opposite the twelfth thoracic and upper third lumbar vertebrae.

Wolkow and Delitzin noted that body form and nephroptosis were related. Becher and Lenhoff, who also noted this, formulated a renal index by measuring the distance from the sternal notch to the symphysis pubis, which is divided by the circumference of the abdomen and multiplied by 100, thus giving the average renal index as 77. Harris, Kelly and the author confirmed these findings.

The etiologic factors which produce ptosis of the kidney are interesting. In assuming upright posture man loses the horizontal fascial support present in quadrupeds who walk on all fours. In man this fascial shelf is anterior, and not under the kidney, thereby offering no support. Variation in the anatomic configuration of the renal fossa favors descent of the kidney. It is well known that individuals with short broad thorax, round abdomen, relatively decreased distance from sternal notch to symphysis pubis, possessing negative renal index, are less prone to develop ptosis; whereas those with long, narrow thorax, thin waist and relatively increased distance from sternal notch to the symphysis pubis are more likely to develop renal ptosis as well as visceroptosis.

In the negative type the renal fossa is deeper and the lower end narrower (resembling an inverted pear), tending to hold the kidney in place; in the positive type it is cylindric in shape, more shallow and the lower end broader (similar to an inverted funnel), permitting descent.

Ptosis of the kidney does not necessarily cause symptoms. In descending the kidney does not always carry the entire ureter down with it, as the ureter may become fastened to the posterior peritoneum 3 to 4 cm. below the ureteropelvic junction. It may become kinked at this point of fixation to the posterior peritoneum, or over an aberrant vessel, or fibrous bands, and impede the outflow of urine causing intermittent hydronephrosis. It is the acute bending or corkscrew formation of the ureter that usually causes the obstruction, resulting in pain due to back pressure, gastrointestinal and nervous symptoms. In some cases of ptosis torsion takes place in which the pedicle and ureter are twisted, giving rise to similar symptoms. When aberrant vessels are present, particularly in the upper pole, the pull on these vessels may also cause pain.

In the interest of the patient and scientific medicine, it is important that the urologist make detailed studies of patients in whom nephroptosis is attributed to trauma. The acute traumas are due to blows on the lumbar region, falling on feet or side of body from a height, or sudden depression of the diaphragm. The resulting obstruction precipitates so-called strangulation symptoms. The sudden descent of the kidney causes stretching of the vascular pedicle and supporting ligaments and may be accompanied by contusion or rupture of the kidney and even its blood vessels. This phenomenon of stretching of the vascular pedicle may be observed in delivering the kidney when mobilizing it for operation.

Chronic trauma may be the result of an occupation requiring standing, weight-bearing over long periods of time, repeated flexion of the body, continuous jolting of horseback riding, motorcycle riding, motor trips over rough roads and excessive strain of coughing or chronic constipation. These factors gradually loosen the kidney, allowing it to descend.

There are two types of nephroptosis due to trauma: (1) in patients in whom trauma may activate latent symptoms in a pre-existing, non-symptomatic, movable kidney, and (2) in those patients in whom acute or chronic trauma actually causes descent of the kidney. Studies by many investigators reveal that the incidence of ptosis is over 22.8 per cent in women and 2.1 per cent in men. In the greater majority of these individuals ptosis causes no trouble. Harris, Kimbrough, Kidd and the author have called attention to the role of trauma in the production of nephroptosis, and Kidd has described, particularly, the role of acute trauma.

The right kidney is usually lower than the left because of pressure by the liver from above, elongation of right renal pedicle, peculiar anatomic configuration and absence of the re-enforcing leaf of Toldt, etc. The supporting ligamentous attachments to the liver, pancreas and duodenum offer little if any support, and in splanchnoptosis the ptosed viscera may actually help pull the kidney downward.

Because of its peculiar formation, the surrounding perirenal fascia is defective in its support. The renal capsule contains muscle as well as cellulofibrous tissue in its upper portion, is attached above and medially to the perirenal fascia and diaphragm, thus making up the suspensory ligament of the kidney. It tends to hold the kidney in place but is an inconsistent support and readily gives way when factors favoring descent come into action. The fatty capsule itself offers no support as the kidney moves freely within this loose adipose tissue. The prerenal and retrorenal folds of the perirenal fascia form an imperfect supporting sheath; they do not join below, the prerenal and retrorenal fascia being lost in the cellulo-adipose tissue of the iliac fossa. On the left side there is the additional fascial leaf of Toldt, formed by the fusion of the left fold of primitive mesentery with the posterior peritoneum, which re-enforces the prerenal fascia affording additional support to the left kidney. The left suprarenal vein arises from the renal vein. It affords additional support and aids in holding the left kidney in place. The prerenal fascia is less developed on the right side. On both sides it is solidly adherent to the superior portion of the renal capsule and hilum, and loosely attached below, favoring descent of the kidney. In addition, the lack of fusion of the two leaves of perirenal fascia below the kidney creates a channel which readily widens as the kidney descends.

The kidney may be displaced by mobilization necessary to carry out various surgical interventions, such as nephro- and pyelolithotomy, plastic repair of the pelvis, partial resection, division of horseshoe kidney, etc. In these cases it is important, and we routinely replace the movable kidney in its proper position by nephropexy. Keeping the patient in the Trendelenburg position for seventeen days after operation assures permanent replacement of the kidney in its proper location.

At a meeting of the French Urological Association I reported five authentic cases of traumatic hydronephrosis, three of which were secondary to nephroptosis. In two patients ptosis of the kidney was produced by direct trauma while working: one (a swimming instructor) received a blow to the loin by a diver, and the other (a laborer) received a blow to the loin by a 259 pound window case while the body was bent forward. The third case was due to indirect trauma; this patient was riding in an elevator when the cables broke, causing it to drop three stories. In all three the kidney was suddenly dislodged from its moorings by trauma, and each of them noted hematuria and severe pain shortly after the accident, indicating contusion as well as descent of the kidney.

In some instances ptosis has been attributed to trauma when actually it has existed for many years prior to the injury. I recall a female bus driver, aged twenty-six, whom I examined in the capacity of independent medical examiner for the Industrial Accident Commission. She attributed advanced third degree ptosis (with its typical symptoms) to an acute strain while suddenly turning the steering wheel in order to avoid oncoming traffic. Films taken in the exaggerated Trendelenburg position revealed the right kidney firmly fixed in a low position (upper pole at the level of the third lumbar vertebra), indicating that the condition had existed for some time prior to the accident. Although the sudden twisting of the body was not the cause of ptosis of the kidney in this individual, it may have precipitated sudden onset of symptoms.

Of equal interest is another patient, a janitor aged forty-two, in whom hydronephrosis and pyelonephritis of the left kidney was noted one year after severe strain (involuntary sudden twisting and hyperextension of the back). Advanced infection of both kidneys, bladder, prostate and seminal vesicles could well have been responsible for symptoms noted five months after strain, namely, hematuria, frequency, dysuria, pain in left kidney. It is unlikely that the involuntary strain of the body caused the hydronephrosis and ptosis encountered in this patient.

The treatment for nephroptosis, and torsion secondary to trauma, is the same as that when trauma is not an etiologic factor.

There has been great controversy over the efficacy of nephropexy. The abuse of the operation at the turn of the century caused it to fall into disrepute, as it was often performed on asymptomatic movable kidney or improperly carried out. Thomas outlined the seven periods in the history of the diagnosis and treatment of nephroptosis. In describing the seventh period "truth" he pointed out that accurate diagnosis afforded by cystoscopy and pyelography, as well as improved surgical technic, has given us a mean position between radicalism and conservatism resulting in better surgery for the correction of movable kidney. Recently Hess and his co-workers carried out nephropexy on thirty-three of 241 patients with abnormal renal mobility. The results obtained were excellent in these thirty-three patients in whom the criteria for nephropexy were carefully evaluated.

Mobility alone is not an indication for operation and there must be evidence of stasis due to ptosis, twisting of the vascular pedicle and ureter due to torsion, or undue tension on renal vessels. In the greater majority of cases movable kidney *per se* causes no symptoms and requires no treatment. In those in whom the symptoms are referable to nephroptosis a careful general examination must always be made to rule out disease of abdominal organs. In many instances operation for mistaken chronic appendicitis, gallbladder disease, colitis, etc., failed to relieve patients suffering from nephroptosis. In order to make an accurate diagnosis of nephroptosis roentgenograms, preferably retrograde, should be made in the Trendelenburg, horizontal and erect positions. Films taken from fifteen minutes to an hour later will reveal delayed emptying of the pelvis due to retention. In intermittent hydronephrosis due to ptosis this sign may not be present unless films are taken at the time of acute attack of pain. In some instances symptoms follow twisting of the renal pedicle

because of varying degrees of torsion and tension due to drag on aberrant vessels of the upper pole of the kidney. In these cases there may be little if any retention of the opaque medium noted in delayed films.

Much debate has taken place over the criteria for nephropexy. It is clearly indicated in the following: patients suffering from classical symptoms (pain, gastrointestinal distress and nervous phenomena) who are not relieved by conservative measures; patients in whom faulty drainage results from the kidney being anchored in an unusually low position due to perinephritis; obese patients and those presenting extensive abdominal scars to whom the supportive action of belts is of no avail; patients presenting chronic infected hydronephrosis, secondary to ptosis, in whom stasis favors chronic infection; patients presenting marked torsion as well as ptosis of the kidney in whom symptoms are due to twisting of the ureter and renal pedicle; in patients in whom calculus, cyst, etc., coexist; surgical replacement of ptotic and non-ptotic kidney upon which other operations are performed. In selected patients, relieved by the supportive belt, permanent cure may be obtained by surgical suspension. This is particularly true of the manual laborer whom the belt prevents from carrying on his work. Some patients prefer operation to wearing cumbersome abdominal supports. Visceroptosis is not a contraindication for operation.

When carrying out nephropexy we emphasize the importance of making a careful examination for coexisting acquired inflammatory or congenital stricture, hypertrophy of fibromuscular tissue or valve formation of the pelvic outlet. In these it is necessary to perform plastic operation consisting of division of the stricture, intubation of the ureter and nephrostomy drainage, as well as nephropexy. Occasionally it is necessary to resect the ureteropelvic junction and reimplant the ureter into the most dependent portion of the pelvis, transforming the static pelvic cavity into a funnel-shaped sac. Correction of the dilated pelvis depends on the condition encountered.

If these criteria are carefully followed, the greater number of patients suffering from the symptoms caused by traumatic and non-traumatic nephroptosis can be relieved by operation.

SUMMARY

The etiologic factors causing nephroptosis are the erect position of man, peculiarity of body form, lack of muscle tone, diminished intra-abdominal pressure, inherent weakness of supporting renal and perirenal fascias, etc.

There are two types of nephroptosis due to trauma: (1) that in which trauma activates latent symptoms and (2) that in which acute or chronic trauma actually causes descent of the kidney.

Acute traumas are due to blows on the lumbar region, falling on feet or side of body from a height, or sudden depression of the diaphragm. The sudden descent of the kidney may be accompanied by contusion or rupture of the kidney and its blood vessels. The resulting obstruction precipitates so-called strangulation symptoms.

Chronic trauma may be the result of occupations which require standing, weight-bearing over long periods of time as well as repeated flexion of body, continuous jolting of horseback riding, motorcycle riding, motor trips over rough roads and excessive strain of coughing or chronic constipation. These factors gradually loosen the kidney, allowing it to descend.

Careful general examination must always be made to rule out disease of abdominal organs when symptoms are referable to nephroptosis. Operations for mistaken chronic disease of the appendix, gallbladder, uterus and adnexa have failed to relieve patients suffering from nephroptosis.

In order to make an accurate diagnosis roentgenograms, preferably retrograde, should be made in the Trendelenburg, horizontal and erect positions. Films should again be taken from fifteen minutes to one hour later, as they will reveal the delayed emptying of the pelvis due to retention. In patients suffering from torsion there may be little if any retention of the opaque medium noted in delayed films, because in these, symptoms are due to twisting of the renal pedicle and ureter.

Nephropexy is clearly indicated in patients suffering from traumatic or non-traumatic nephroptosis who do not respond to conservative treatment. If the criteria listed in the text are carefully followed and nephropexy properly carried out, the majority of patients suffering from nephroptosis may be relieved.

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CARDIOMYOTOMY has proven to be a more superior operation for the treatment of achalasia of the esophagus or cardiospasm than has resection of the lower end of the esophagus (esophagogastrectomy) because it is less often followed by regurgitation of gastric contents into the lower end of the esophagus with resultant esophagitis and/or peptic ulcer formation. In cases of cardiospasm the incision, anteriorly and posteriorly, and occasional fusiform excision of the muscular ring may be performed via an abdominal incision, which extends lower on the cardia than in cases of achalasia of the esophagus. In these latter instances a thoracic approach is preferred. (*Richard A. Leonardo, M.D.*)

Bowel Perforation Due to Non-penetrating Abdominal Trauma

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TRAUMA to the abdomen may be classified as penetrating or non-penetrating. In the former, the patient as well as his doctor is immediately concerned as to the possibility of intra-abdominal injury. In the latter, both may be lulled in the absence of any external wound and frequently in the absence of any early signs or symptoms of internal injury.

Blows to the abdomen from blunt objects are common, and seldom produce serious damage. The degree of injury is related to the speed with which the force is applied, the direction of the force and the size of the offending object. The mobile abdominal viscera can move from the path of the blow, and injury is most common to the relatively fixed viscera: the spleen, liver and kidneys. Tears of the intestine likewise are near the points of fixation, jejunum near the ligament of Treitz, ileum near the cecum, and sigmoid.

Fullness of the intestines and bladder render them more susceptible to injury as does the presence of coexisting pathologic disorder, such as diverticulitis, ulcers and adhesive bands.

In tears of the liver or spleen hemorrhage is the dominant finding and alerts one as to the nature of the injury. The signs and symptoms of perforation of the bowel will be immediate if there is sufficient tear for spillage of bowel content. Undoubtedly, frequently there is only severe contusion and hematoma at the site of injury, initially, with perforation and signs and symptoms of peritonitis occurring hours or days later.

Tenderness and rigidity are constant with spillage of intestinal contents into the peritoneal cavity. Presence of free air is fairly conclusive of perforation, although its absence is of no significance. Other signs of tachycardia, fever and varying degrees of shock may be present.

Following are reports of two cases of perforation of the small bowel, and two cases of perforation of the large bowel due to non-penetrating abdominal trauma.

CASE REPORTS

CASE 1. Patient R. L. McG., a thirty-five year old white man, was admitted to the Veteran's Hospital, Huntington, West Virginia, at noon on September 3, 1951. He gave a history of having been gored by a bull at about 11:30 P.M. the day before. He was knocked unconscious and lay in a field for an undetermined length of time, regaining consciousness at about daybreak. He had severe abdominal pain and vomited repeatedly, the vomitus being dark. His urine was grossly bloody.

On admission, physical examination revealed a temperature of 102.8°F., pulse 132, respirations 45, blood pressure 120/80. The pulse was weak and respirations were shallow. There was generalized abdominal tenderness and rigidity. The bladder was distended. The skin revealed no bruises, or external signs of injury. There was a bloody discharge from the rectum.

Laboratory work-up revealed white blood count of 3,650, red blood count 4,700,000 with 100 per cent hemoglobin. X-ray of the abdomen revealed no free air in the peritoneal cavity.

A laparotomy was performed through a lower left rectus incision. Perforation of the rectosigmoid colon anteriorly, just above the peritoneal reflection, was found. Perforation was approximately 2½ inches in length. There was approximately 1,000 cc. of bloody fluid in the peritoneal cavity. The laceration was sutured. The pelvis was drained with Penrose drains through a stab wound in the left lower quadrant. All gross contamination was removed and the pelvis irrigated thoroughly with saline. A transverse loop colostomy was then performed. Sulfamylon was placed in the peritoneal

cavity. The patient's immediate postoperative course was stormy. On the second day atelectasis developed in the right base, and on this day the transverse colostomy was opened. Thereafter, he improved until the eighth day when the wound dehisced and was resutured with through and through No. 30 wire sutures. The patient's course then continued satisfactorily. His temperature was completely normal by the fourteenth day and the wire sutures were removed. The patient was discharged on October 5th, at which time he was asymptomatic.

CASE II. Patient C. R. P., a twenty-three year old active serviceman, was admitted to the hospital on November 4, 1951, at about midnight. Three hours previously he had been in an auto accident, while a passenger in the front seat. He had been asleep at the time, was unconscious immediately following and did not remember the accident. He was taken to a local hospital and later transferred here.

Physical examination on admission revealed his blood pressure to be 100/64, pulse 136, respiration 22 and temperature 101.4°F. The patient appeared acutely ill and in considerable pain. He was oriented at this time and was trying to vomit. There was fresh blood about the nose. Abrasions were present on the right side of the face and forehead and there was a superficial laceration of the scalp in the occipital region. There were contusions and abrasions on the inner aspect of the right arm and abrasions across the lower abdomen in the region of the iliac crest and inguinal region. He also had abrasions of both knees. There was no evidence of fracture. There were moist rales present in the right axilla near the base. Generalized rigidity of the abdomen was present. Peristalsis was at first normal but then the abdomen became completely silent. Rectal examination was negative. Catheterized urine showed no gross blood.

Laboratory work-up revealed white blood count of 15,650, 71 per cent neutrophils, hemoglobin was 106 per cent; urinalysis showed 1 plus albumin, many casts and an occasional white blood cell. X-ray of the abdomen was normal and there was no free air under the diaphragm. Chest film was also normal.

Under general anesthesia, the abdomen was opened through a left rectus incision. There was old blood present in the peritoneal cavity amounting to about 2,000 cc. A perforation of the ilium about 4 or 5 inches above the ileocecal valve was found and this was sutured transversely. A segment of ilium about 2 feet in length just proximal to this was gangrenous due to laceration of the mesentery. The segment was resected and end-to-end anastomosis was performed. The patient received four blood transfusions or 2,000 cc. His postoperative course was surprisingly mild. Gastric suction was discontinued after three days and the patient was fed. At the time of discharge, he was on a full diet and the wound was well healed. He was discharged from the hospital November 19, 1951.

CASE III. Patient G. C. C., a sixty-three year old white man, was admitted to the hospital on October 9, 1951, at 8:30 A.M. On the day before admission at about 8:00 P.M., the patient fell down a slight hill and struck his abdomen against an old stone crock. He had immediate abdominal pain which persisted until admission to the hospital. He was previously hospitalized at this hospital in February, 1951, at which time lecystectomy and appendectomy were performed with uneventful recovery.

Physical examination on admission revealed an acutely ill, dehydrated patient in severe pain. His blood pressure was 110/90, pulse 126, respirations 30 and temperature 97.4°F. The mouth was dry. Respiratory movements of the chest were limited. Moist rales and rhonchi were scattered throughout both lung fields. The heart did not seem enlarged. No murmurs were heard. The abdomen was rigid, distended and silent. There was generalized tenderness. No sign of abrasions or other external injury to the abdomen was noted. Most of the patient's pain appeared to be in the left lower abdominal quadrant.

Laboratory findings revealed a white blood count of 11,300, neutrophils 84 per cent, red blood count 5,550,000 with 110 per cent hemoglobin. Urine revealed 1 plus albumin, many red blood cells and many white blood cells and a few coarsely granular casts. The patient was taken to the operating room at 1:10 P.M., about seventeen hours after the initial injury. Fluids were started and spinal anesthesia administered. The patient went into profound shock in a few moments and no pulse or blood pressure could be obtained. The right radial artery was exposed. Through a 16-gauge needle he was given 2,000 cc. of whole blood; 1,000 cc. of normal saline was also adminis-

tered. After about an hour his blood pressure came up to 100/60 and he became conscious. Inasmuch as the patient did not have enough anesthesia from the spinal to carry out a laparotomy, he was given pentothal and the peritoneal cavity was opened through a left rectus incision centered opposite the umbilicus. The peritoneal cavity contained about 4 L. of turbid fluid. There were many adhesions in the region of the previous laparotomy scar. The whole abdomen was explored and a perforation 2 cm. in length was found on the antimesenteric border of the jejunum approximately 5 feet from the ligament of Treitz. Perforation was closed transversely. The peritoneal fluid was aspirated from the peritoneal cavity and the abdomen was closed with through and through stainless steel wire sutures. The patient left the operating room in very poor condition. His postoperative course was extremely stormy. The day following operation his chest filled with moist rales and there was essentially no urinary output. The urinary output returned the following day. On October 13th, bowel sounds became audible. On October 16th, he began to have liquid bowel movements and the abdomen was soft. During this time he was on continuous gastric suction, intravenous fluids, penicillin and streptomycin. Despite this he ran a febrile course, 1 to 2 degrees elevation daily. His temperature became normal on November 4th. Evidence of large bowel obstruction developed and on November 16th transverse colostomy was performed. The patient thereafter had a slow but steady improvement and on February 6, 1952, the colostomy was closed. At the time of discharge he had a large ventral hernia but was feeling well and had regained his normal weight.

Case IV. Patient O. F., a thirty-two year old white man, was admitted to the hospital July 10, 1952. This patient had rupture of the sigmoid colon following an auto accident in September, 1951. Low abdominal pain was present but no abdominal wound or abrasion was noted. At laparotomy the patient was found to have a perforation of the sigmoid colon, approximately ½ cm. in diameter. Original surgery was carried out at a Pikeville, Kentucky hospital. Severe peritonitis had developed and the patient had had a stormy postoperative course. Six weeks prior to admission here intestinal obstruction developed and he was re-explored. Adhesions involving the small bowel were released and he did fairly well after this. The patient returned home where diarrhea, nausea and vomiting occurred, accompanied with considerable abdominal pain. On the day of admission to this hospital the patient was emaciated. There was marked ascites. The ankles were extremely edematous and he had a complete bowel obstruction. His temperature ranged as high as 102°F. daily.

Laboratory work showed a total protein of 5.3, globulin of 3 and albumin 2.3. Complete blood count showed a white count of 5,200, red count of 4,310,000 and hemoglobin of 14.5 gm. per cent. Urinalysis showed a trace of albumin and 1 plus sugar. Prothrombin time was 52 per cent. Chest film was within normal limits.

Physical examination revealed a chronically ill white man. The face was puffy and many teeth were missing. There were moist rales in the bases of the lungs. The heart was of normal size and the sounds were regular and of good quality. No murmurs were heard. The abdomen had a low midline scar, well healed. It was markedly distended, contained much peritoneal fluid as well as gas-filled loops. There were hyperactive peristalsis. Both testicles were atrophied. Rectal examination was normal. His feet and legs were very edematous and arms and legs showed numerous veni puncture marks.

Patient was treated immediately upon hospitalization with intravenous fluids. A Cantor tube was inserted on the day of admission. The patient was readily decompressed but on clamping off the Cantor tube he immediately became distended and began vomiting again. On July 24th exploratory laparotomy was carried out. At that time a loop of small bowel was found to be involved in an inflammatory mass and firmly adherent to the patient's old laparotomy scar. Proximally, the small bowel was dilated to approximately 2 inches in diameter and was paper thin. It was impossible to free the bowel from the inflammatory mass and an ileotransverse colostomy in continuity was performed just proximal to the mass.

Because of failure of relief from this procedure and x-ray evidence of a stricture of the sigmoid on July 28th, a double-barrel colostomy was carried out. Postoperative atelectasis

developed. However, both the ileotransverse colostomy and the descending colon colostomy functioned well. The patient had as many as twelve or fifteen liquid stools daily but could be kept on oral feedings and the edema of the extremities disappeared as did the abdominal distention. Gastrointestinal series on October 7th showed that the enterotransverse colostomy was in the upper half of the jejunum but it functioned well. On October 15th the patient was re-explored under spinal anesthesia. The jejunal transverse colostomy was taken down. The loop of jejunum involved in the inflammatory mass was bipassed and an end-to-end anastomosis of the healthy jejunum was carried out. The ends of the jejunum that were in the inflammatory mass were brought to the outside as mucous fistulas. Patient had a smooth convalescence from this procedure. On November 3rd the mucous fistulas of the jejunum were removed. Convalescence from this procedure was uneventful. The colostomy closed spontaneously and the patient began having normal bowel movements. He was sent on leave and then discharged on December 10, 1952. Patient at this time was eating well, was symptom free and weighed 104 pounds. He was re-examined on April 22, 1953, at which time he was totally asymptomatic, weighing 156 pounds.

SUMMARY

Perforation of the bowel due to non-penetrating trauma is attended with a high morbidity rate. In the absence of an obvious wound the patient is reluctant to seek medical care. Often, as in farm injuries, the patient is alone at the time of injury and is unable to get to a place where medical attention is available. Sometimes, the doctor is prone to procrastinate in the absence of a wound of the abdominal wall. The rapidity with which repair is carried out determines to a great degree the smoothness of convalescence as shown by the patient operated upon three hours after injury. In any patient with questionable injury to the viscera, laparotomy either must be carried out immediately or the patient must be watched constantly for signs of such injury.

Bosworth has stated that perforations of the small bowel occur about once in every 10,000 hospital admissions. The over-all mortality rate given for his series of cases was 34.5 per cent, with an operative mortality rate of 29.3 per cent.

In this series of four cases there was no mortality. However, three of the patients had stormy convalescences.

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The Care and Treatment of Varicose Veins*

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In any discussion of varicose veins we must first realize that we are dealing with one of the progressively degenerative processes that affect the human body.[3] Many patients are born with venous anomalies and arteriovenous fistulas, but here we are discussing that varicose condition of the veins of the lower extremities commonly spoken of as varicose veins. They may be congenital and present at birth, or show their presence only as the years go by.[1–3]

There is much evidence, we think, to indicate that varicose veins are veins in which the muscular fibers in the walls are deficient or nearly absent, and in which the valves are weak and cannot stand the back pressure of the column of blood from above. The walls and valves may be strong enough until the additional pressures and forces of middle and adult life come into play, such as the increase of the intra-abdominal pressure associated with heavy work and lifting, or the increase of the blood volume and pressure associated with pregnancy. With pregnancy there is a relaxation of the smooth muscles of the body structures, including those present in the vein walls. This latter seems to be associated with a disturbed ovarian function and hormone production.

There is no set rule in the treatment of varicose veins, rather we must *individualize* the patient. Each patient must be considered as a separate and distinct entity and studied by himself.

The essential steps in the treatment of varicose veins are three: (1) There must be an adequate examination of the case at hand. (2) An adequate surgical procedure must be performed. (3) The patient must have adequate follow-up care and treatment as time goes by. If these three steps are well performed we can be assured of having an ideal result in the great majority of cases.

On examination we must decide whether we are dealing with an arterial or venous disease. We must decide which system is involved, locate and mark any perforating or incompetent veins, if such be present, and then decide what type of a procedure should be carried out to correct the condition.

The proper course can best be found by taking a careful history of the individual case, followed by a careful and detailed inspection of the entire extremity from the groin to the toes. We then palpate the entire leg, searching for varicose veins; often you will feel on careful palpation what cannot be noted by mere inspection.

In discussing the history of any case of varicose veins we must first consider the onset.[7,8] Are they congenital? Are they associated with and following deep thrombophlebitis,[9,11,13] pregnancy, some general infection or pneumonia? Does the patient do hard labor? Has the development been gradual or rapid in formation? Have the veins enlarged with each succeeding pregnancy? Has the patient worn external support, such as the Ace bandage or elastic stocking? Has the patient been treated by the injection method over a period of years? At any time has an effort been made to give the patient the benefit of surgery?

The most common symptoms and complaints[7,8] for which the patient seeks medical attention are pain and cramps through the area of the varicose veins and through the calf of the lower leg. If this pain is arterial in type and origin, it is increased with walking and decreased with standing, and is crampy in nature. Often there is night pain, shooting in type.

However, if the pain is due to varicose veins, usually it is decreased with walking and increased with standing. The patient complains of an aching and heaviness through the calf and lower leg, and often has night cramps.

These patients frequently present ulceration (Fig. 1) and we must decide whether the ulcer is arterial or venous in nature.[9,20] Arterial ulcers are most commonly seen about the toes and

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heels, external in the lower leg and anterior lower tibia, in elderly patients, who are very thin and have little subcutaneous tissue, with a thin paper-like skin. Venous ulcers most commonly appear about the malleoli, both internal and external, more commonly internal. Ulcerations due to fungi and fungus infections commonly develop just below the malleoli, both internal and external. These ulcerations usually are not so deep; they are more superficial and show much evidence of extensive dermatitis through that area.

Is the history of ulcers a recurrent one? Has there been a repetition of ulceration with healing, and ulceration again?[11] Is there clearly a direct relation of the varicose veins present to the ulcer formation? Do large varicose veins from above feed directly into the ulcer area? We must always suspect the presence of perforating veins under the ulcer and in the ulcer area, and this is most important.

The presence of edema in any condition of the lower extremity is very important and must be studied in detail. As a rule edema does not occur with arterial ulcers or arterial conditions,[20] but there may be very slight edema and at times considerable edema, at least a grade II. This is due to a stasis of a failing circulation. The edema due to varicose veins usually occurs about the ankle, or maybe the entire lower leg, more so at the end of the day, and is usually gone by morning. The developing edema, associated with and following a deep thrombophlebitis, is usually rapid in onset and involves the entire lower leg; and if the deep phlebitis has extended upward to the groin, the entire lower extremity, groin to toes, is usually badly swollen.

Inspection of the extremity is the most important single point of all. If the condition is venous in origin, much more cyanosis will be present; while if it is due to an arterial obliteration, pallor and signs of ischemia will usually be noted. If the edema is post-phlebitic, there will probably be signs and symptoms of vascular spasm, and with this, often, the cold clammy foot which means extreme sympathetic activity. If the disability of the extremity is due to arterial disturbance, the skin is usually pale, anemic and often ischemic in appearance. There is marked loss of hair growth along the front of the lower leg. The skin will be dry and parchment-like, often with a red tinge. The fine arterial capillaries may be prominent

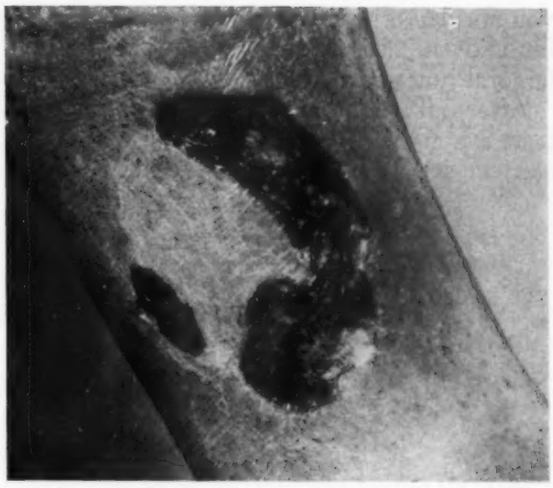

FIG. 1. Typical varicose and postphlebitic ulcer.

and the skin temperature is usually below normal.

Palpation of the extremity is very important. This is done first with a light pressure of the finger tips and then, as the soft spots of the varicose veins are found, firmer pressure is made. In this way you can often follow the course of the varicose vein, even though it may be tortuous, throughout the entire lower extremity. Are the normal arterial pulsations present? Is the dorsalis pedis pulsation present? Can the posterior tibial artery pulsation be felt? Does the varicose condition involve the greater or lesser saphenous system? Which one the most? Much time should be spent in looking for the incompetent perforator veins.

Together with palpation we use percussion. (Fig. 2.) This is best done with a tapping, hammer-like motion on the vein and preferably against a firm part of the leg such as the bone of the knee or the tibia. At times compression over a large tortuous sac or group of varicose veins will give the same effect. The tapping or pressure causes an impulse to pass upward and downward along the vein. This can be felt in either direction with the fingers of the other hand. Of course the impulse is felt more clearly and more distinctly upward than downward. This is commonly called the Schwartz test, more properly called the PPT test or the percussion pulse transmitted. By means of the percussion the impulse can be followed upward through the fat of the thigh to the saphenofemoral junction, and many times the course of the vein can be outlined where it could not be found at all otherwise. This will also give

you an idea of the size of the vein deep in the fat and the size of the vein at the saphenofemoral junction.

After all the foregoing examinations and tests are made, the Trendelenburg test is then used in detail.[6] This will be the final point in

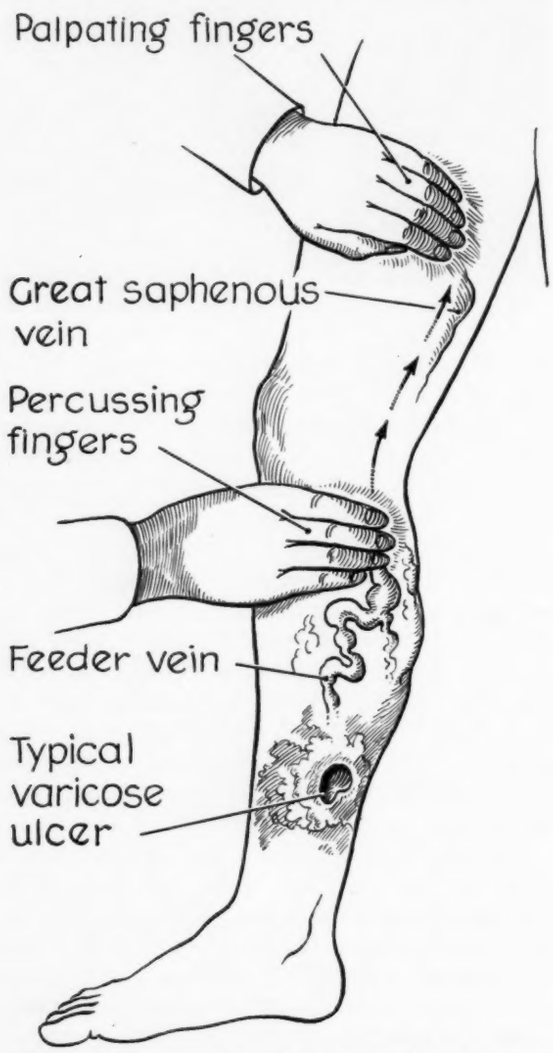

FIG. 2. Demonstration of the percussion pulse test to locate the course of the varicose veins through the thigh and at the groin.

making the decision as to the system involved, and often the site of the incompetent perforating vein.[12,17,18] The Trendelenburg test is one of the oldest tests in the diagnosis and treatment of varicose veins. Some authorities say that this test is of no value whatsoever and have given up its use entirely, but we believe that it is one of the most important. In making the Trendelenburg test, the prominent segments of the varicose veins are marked with mercurochrome or some marking solution. The patient then lies down with the leg in high elevation to drain all the blood from the varicose segments. A tourniquet is applied just above the knee, and the patient is allowed to stand. If the reverse flow of blood is entirely from above at the saphenofemoral junction, the veins below the tourniquet will remain empty until it is removed. This is called the Trendelenburg positive. If the perforating or communicating veins are incompetent, the veins in the lower extremity will fill rapidly, even though the tourniquet is applied. This is spoken of as the Trendelenburg negative. The Trendelenburg test is then repeated with the tourniquet applied at the mid-thigh and at the groin, and in this way we can locate where the reverse flow of blood comes from, whether through the perforator veins in the lower leg, in the lower thigh, or whether it is entirely from the saphenofemoral junction.

There are some cases of varicose veins that can be very properly and completely treated by the injection method only[3,5] even though some authorities on the subject say injections should never be given at any time. We see no reason for subjecting the patient to a radical surgical ligation or stripping when all they present are small superficial veins, ½ to 1 cm. in diameter, with no reverse flow.[13] In these cases there is merely a dilation of segments of the varicose veins here and there, and they can be completely and easily eliminated by the use of the injection method only.

If the case is more extensive, with a very definite retrograde or reverse flow from the saphenofemoral junction, through perforator veins, or from the junction of the short saphenous with the popliteal vein, then a ligation at any or all of these places must be done. (Fig. 3.) The vein must be ligated at the point of the reverse flow regardless of where that may begin.

If the reverse flow is from the saphenofemoral junction but the varicose veins below are superficial and very tortuous, then it is much simpler to perform a high ligation[1] and then give a retrograde injection of the sclerosing solution into the superficial tortuous vein below, using the empty vein technic. Again in a great majority of cases this will give a perfect and lasting result.

If the case is an extensive one with large varicose veins, 2, 3 or 4 cm. in diameter (Fig. 4)[4] in the thigh and lower leg, a retrograde

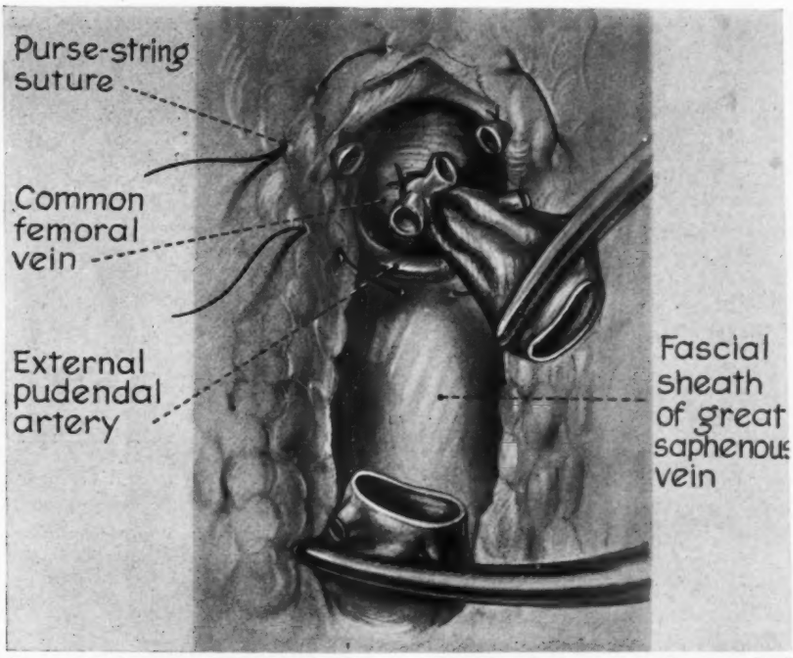

FIG. 3. High saphenofemoral ligation showing the placing of the ligature flush on the wall of the femoral vein above all tributaries. The purse-string suture is in place and the distal stump below remains clamped.

injection would be entirely wrong and out of place.[2] Whenever there is a reverse flow from the saphenofemoral junction or the saphenopopliteal junction, we prefer to follow the ligation with a stripping of all the varicose veins possible.[6] We believe that the main saphenous vein, at all odds, must be stripped from the groin to the knee or lower, where it most commonly branches over the calf and internal lower leg.[4] (Fig. 5.)

Having followed several thousands of cases of varicose veins postoperatively over a period of years, we have found that in many patients who have had a good high saphenofemoral ligation recurrences of the varicose condition have developed in the thigh and lower leg.[2] These recurrences have developed most often through large perforating veins in the thigh segment of the system, and for that reason we believe that the great saphenous vein with its tributaries should be stripped as completely as possible from the groin to the knee.[3,4]

If the Trendelenburg test has shown no evidence of incompetent perforating veins in the lower leg,[17] and if the veins in the lower leg and over the calf are only 1 cm. or slightly larger in size, then a high ligation with stripping to the knee and a retrograde injection of sclerosing solution at that point will give a fine result.[10] This retrograde injection can be done at the time of the operation, again using the empty vein technic.

If the patient is one in whom various segments of the varicose veins in the lower extremity are extensive and 2, 3 or 4 cm. or larger in size (Fig. 4) and the veins are very tortuous, through which it would be almost impossible to pass the stripper, then we believe it is far wiser to make a larger incision over this area, with complete dissection of the varicose vein area. This can well be done by blunt dissection and a spreading dissection with forceps. At times it is best performed with sharp dissection, with complete excision of the entire area down to the deep fascia.

If in connection with this varicose condition infection has been present throughout the superficial fascia, such as we see in cellulitis, it is often better to perform radical resection of the entire area from the skin down to the deep fascia; the area is then closed, letting the skin rest directly on the deep fascia. Sometimes the Linton operation,[7,8] with a complete excision of the deep fascia letting the skin rest on the muscle, is the best method. In the extreme case which has gone on for years with repeated attacks of cellulitis, with much edema and damage to the skin tissue and obliteration of

FIG. 4. Extensive case of varicose veins of inner thigh and lower leg. This type is too large for injection. Such a case must be treated by a primarily high saphenofemoral ligation above all tributaries, closure of the foramen with a purse-string ligature, stripping of the saphenous vein and the tortuous varicose mass and then blunt dissection of the tortuous varices through segmental incisions, with injection of the small tortuous terminal veins about two months postoperatively.

Fig. 5. Typical extensive case of varicose veins showing the accessory vein through thigh and inner knee which can be stripped well to the mid-third of lower leg. The tortuous mass in the lower third must be removed by multiple incision and blunt dissection. It also shows the terminal saphenous at the ankle leading to the distal venous arch.

the lymphatic vessels, saphenofemoral ligation is often wise, followed with as complete stripping of the varicose veins as possible. This should be followed by radical excision of the degenerated skin with its infection, down to and through the deep fascia. After this, a split-thickness skin graft from the skin of the other thigh should be applied. This technic will give a better result in the great majority of cases than will a pedicle flap which is often lost. All cases of varicose veins of the lower extremity, having surgery and surgical care, regardless of how extensive they may be, must have adequate support if and as needed. This must be applied immediately at the time of operation and then continued as long as it is needed. If there is edema in the leg, it may be weeks, months or years after surgery. This means that the patient must wear a support. As Dr. Luke of Toronto said, "They must learn a new way of life."[2,11] They must wear an adequate support to counteract the damage to the normal circulation.

Following all the operations and care, regardless of what it may be, the patient must never be discharged as cured because this is a progressively degenerative condition and more varicose veins will develop as time goes by. On the contrary, give the patients a definite date as to when they are to return to the office for further examination and care. It is very important to make follow-up injections of the sclerosing solution into the scattered segments of veins not completely removed at the time of surgery. This must be done with meticulous care, observation and effort. In the ordinary case, each year will see the development of more varicose veins. If a good surgical ligation,

stripping and dissection has been done, the new varicose segments can usually be cared for by injections only. If perforator veins or communicating veins do open up and develop, they in turn must be ligated. Injections alone into the communicating veins are of no value.

In conclusion let me repeat that every patient must have an adequate examination, must undergo an adequate surgical procedure for the case at hand and must have adequate follow-up care and treatment in subsequent years.

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Surgical Complications Associated with Intraperitoneal Colloidal Radiogold

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SINCE the first report of the use of radioactive colloidal gold (Au-198) in the treatment of effusions secondary to malignancy by Muller in 1949,[20] reports attesting to its effectiveness have appeared in the literature with increasing frequency.[1,4,7,9,10–14,17,18,23,24,28–30] Although much attention has been directed to safe methods of handling and radiation protection,[1,4,9,13,24,29] relatively little has been said of local surgical complications incident to the procedure of inserting the gold.[24] Two cases of abscess formation and intestinal fistula formation following instillation of radiogold into the peritoneal cavity have been reported.[22] It is the purpose of this paper to report a third case presenting these complications accompanied by gas infection and necrosis of the abdominal wall and to emphasize the surgical considerations in using radiogold in the peritoneal cavity.

CASE REPORT

A sixty-three year old white married woman was first seen at Madigan Army Hospital in February, 1953. In 1943 a left radical mastectomy had been performed at another hospital for carcinoma of the breast without axillary metastasis. Postoperative roentgenotherapy was administered to the left chest wall and axilla (dosage and factors unknown).

When first seen here the patient presented no evidence of recurrence or metastasis. The right breast was quite large and pendulous and she thought it a cosmetic liability. A right simple mastectomy was performed. Pathologic examination revealed no evidence of carcinoma.

In May, 1953, abdominal enlargement and crampy abdominal pain was noted. Over a period of several days the pain increased in severity and became localized in the right lower quadrant of the abdomen. The patient was admitted to the hospital, with physical findings suggestive of acute appendicitis.

On May 20th, an exploratory laparotomy was performed. Upon opening the abdomen, 3,000 cc. of straw-colored ascitic fluid were released. The serosal surface of the ascending colon presented many small areas of induration as did the falciform ligament. In the pericolic fat of the sigmoid colon was a flat grayish white plaque 1 cm. in diameter. There was a similar plaque on the dome of the bladder. A biopsy of each of these lesions was performed. Pathologic examination revealed carcinoma cells in the ascitic fluid and metastatic adenocarcinoma in each of the biopsy specimens. It was the opinion of the pathologist that these were secondary to the carcinoma of the breast.

The patient's postoperative course was satisfactory. A search for further metastatic lesions or a second primary lesion was instituted. Careful physical examination, intravenous pyelogram and roentgenograms of the chest, osseous structures, upper gastrointestinal tract and colon were normal.

On June 10, 1953, paracentesis was again required. Three thousand cc. of straw-colored fluid were removed and cytologic examination again revealed carcinoma cells.

A course of roentgen therapy was instituted with the hope of relieving the ascites. Between June 13th and August 24th the entire abdomen was irradiated through eight 15 by 17 cm. portals using the following factors: 200 kv. p., 20 ma., 50 cm. T.S.D., Thoreus filter, HVL-1.95 mm. Cu, 200 r (in air) to each of two portals daily. A tissue dose of 1,700 r was attained at the mid-abdominal plane.

This course of treatment failed to decrease the rate of fluid formation and paracentesis was necessary on July 9th. At this time some difficulty was experienced in inserting the trochar and only 1,000 cc. of fluid were obtained.

Several days later localized cellulitis developed at the site of insertion of the trochar, 2 cm. above and to the right of the umbilicus. This never completely subsided and the possibility of injury to the bowel was entertained. Paracentesis was again required on July 21st.

On July 29th the patient was sent to another hospital where 150 mc. of radioactive colloidal gold (Au-198) were inserted intraperitoneally on the same day. The consultant's report was as follows: "In making the incision and opening for the catheter through the abdominal wall and peritoneum, a pocket of greenish fluid was encountered as the layers of the abdominal wall were separated; 3000 cc. of ascitic fluid were removed and 150 millicuries of gold instilled. Twenty-four hours later the patient developed subcutaneous emphysema of the left chest wall, neck and abdomen. The paracentesis wound discharged dark green fluid and the patient had a febrile course. Procaine penicillin, 300,000 units, and dihydrostreptomycin, 0.5 gram, were administered intramuscularly twice daily." The patient improved but returned to Madigan Army Hospital on August 5th.

At the time of re-admission there was an area of cellulitis around the paracentesis wound. An abscess presented in the wound and on August 6th a fecal fistula opened at this site. The patient's course again became febrile, the cellulitis extended and she lost large quantities of fluid through the fistula.

Penicillin and streptomycin were continued and intravenous feedings were instituted. By August 13th two areas of necrosis of the abdominal wall appeared. One of these was 4 cm. in diameter in the right lower quadrant of the abdomen and the other 15 by 18 cm. in the left lower quadrant. On August 18th crepitation of the abdominal wall was noted in addition to the cellulitis. Roentgenograms of the abdomen made in the anteroposterior and lateral projections demonstrated gas in the subcutaneous tissues. (Figs. 1 and 2.)

The patient was isolated and the dosage of procaine penicillin was increased to one million units every eight hours. Cultures taken from the area at this time demonstrated Escherichia coli and anaerobic streptococci. On August 19th fecal-like liquid began to drain from the lower margin of each of the necrotic areas which had begun to separate at the edges. The use of streptokinase-streptodornase was considered

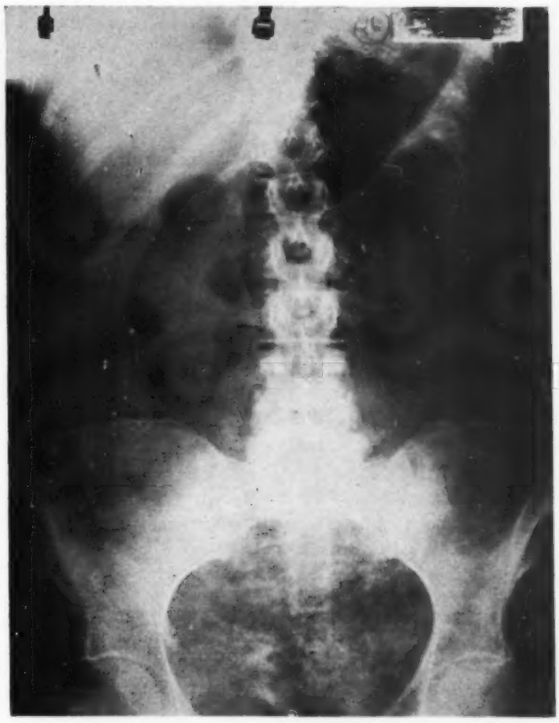

FIG. 1. Roentgenogram of the abdomen. Note absence of "ground glass" appearance of ascites and diffuse small gas bubbles in abdominal wall.

in the management of the necrotic areas but decided against in the light of previous experience using these substances in irradiated areas.[5]

By August 26th the crepitation of the abdominal wall had disappeared as had the acute cellulitis, but the two areas of necrosis continued to drain large amounts of fecal-like fluid. The patient became moribund and was disoriented most of the time. Severe electrolyte imbalance developed which remained uncorrected at the time of the patient's death despite intravenous fluids.

On September 3rd the necrotic skin in the left inguinal area was débrided and a large area of necrotic fat was exposed. This was excised on September 4th. (Fig. 3.) The fascia of the external oblique muscle was exposed over an area of at least 20 by 30 cm. A large abscess cavity was encountered and drained. The area was packed with iodoform gauze. The same procedure was performed in the right inguinal area. Following this there was no drainage from these two areas and the nursing problem was greatly simplified.

On September 4th acute infection developed in the right submaxillary gland. Moderate voltage roentgenotherapy was administered and

FIG. 2. Lateral roentgenogram of the abdominal wall. Note gas in subcutaneous tissues of the anterior abdominal wall.

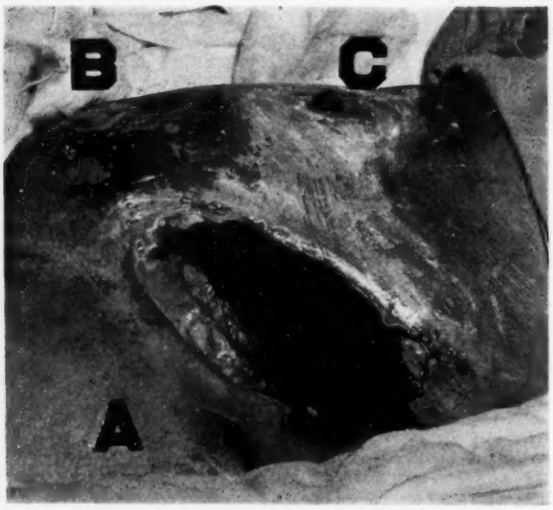

FIG. 3. Photograph of abdominal wall. Note large area of necrosis in the left lower quadrant (A), smaller area of necrosis and residual radiation reaction (B) and intestinal fistula (C).

by September 7th the swelling had subsided 75 per cent.

The patient expired on September 8, 1953. Autopsy permission was not obtained.

COMMENTS

Radioactive colloidal gold has been used for the treatment of intrapleural and intraperitoneal effusions secondary to malignant disease in over 300 cases in the past four years.[29] At the present time it probably represents our most valuable weapon in the management of these cases. Reports of 30 to 90 per cent good results following its use have been published.[1,4,7,9–14,17,18,20,23,24,28–30] Much has been written regarding safe methods of handling to prevent radiation exposure to personnel.[1,4,9,13,24,29] Experimental work has been done to determine safe dosage levels by various routes of administration.[9,16,21,25–27,29]

Several authors have described the pathologic changes produced and the metabolism and distribution of the material following instillation into serous cavities.[2,8,9,11,15,29] Dosage calculations have been difficult because of the irregular surface covered by the isotope.[29]

The exact mode of action in the suppression of effusions is as yet unknown. The following possibilities have been suggested and seem the most likely at present: (1) the elimination of free carcinoma cells from the effusion; (2) possibly a direct action on numerous seedlings of tumor present on the serosal surface; (3) mesothelial fibrosis; and (4) fibrosis of the small blood vessels of the peritoneum.

Only two reports of complications following its use have been published to date. One of these describes radiation sickness and the other aplastic anemia attributed to Au-198 in the bone marrow.[3]

Some warnings of possible local complications have been published, but this subject has not been discussed much to date.[24] Only two other cases of local abdominal complications have been reported.[22]

The local complications that may occur during and following intraperitoneal insertion of radiogold may be divided into two major classes: (1) those due to surgical trauma and

(2) those due to local radioactivity. A combination of these is possible, e.g., injection of the entire dose of radiogold into a small loculated area of peritoneal fluid.

The complications due to surgical trauma are the same ones that could and do occasionally occur following "blind" trochar paracentesis of a severely diseased and distorted peritoneal cavity.[6] The main complications in this class are infection (either cellulitis or abscess formation), peritonitis, perforation of a viscus immobilized by adhesions secondary to tumor masses, previous paracentesis or operative procedures, fistula formation and possibly even hemorrhage from trauma to a blood vessel in a tumor mass. While these complications are well known by surgeons, we believe they should be re-emphasized in relation to the present problem and that radiogold should never be "blindly" injected through a trochar.

To date no experimental evidence that adhesions are caused by radiogold in the peritoneal cavity has been presented. In autopsies performed on patients dying following the insertion of radiogold it has been difficult to determine if the adhesions present were due to the primary malignant process or the radiogold.

Necrosis due to localized overirradiation could result from injection of a large portion of the Au-198 directly into the abdominal wall. This is a preventable accident and the possibility has occurred to many workers as witnessed by the many types of instruments used to prevent such an occurrence. Some workers use a long, large caliber needle, others use an Ochsner cannula and still others insert a polyethylene catheter through an abdominal puncture wound.[1,4,12,13,24,29]

If a large portion of the dose were injected into a small loculated area of the peritoneal cavity, necrosis of the intestinal wall with secondary peritonitis and fistula formation could occur. Methods to avoid this have also been developed. If loculation is suspected, some authors perform a laparotomy, explore the abdomen, free any loculations encountered and insert catheters through tunnels in the abdominal wall into each lumbar gutter for administration of the radiogold.[4,24] Others employ pneumoperitoneum as an aid in visualizing such loculations.[17,18]

An aid in the prevention of local overirradiation and necrosis is routine survey of the abdominal wall utilizing a shielded G-M counter.[24,29] A chart of the area may reveal any extremely "hot" area. If injection has occurred into a loculated area, it would be better to remove the gold by aspiration than to risk the complication of intestinal necrosis. Injection of a large amount of radiogold into the abdominal wall can be managed by local excision of the area.*

We do not believe that localized overirradiation was a factor in the case reported here. No radioactivity was demonstrable in the necrotic skin and fat removed from the abdominal wall. No pigmentation of the abdominal wall was noted and no gold particles were found in the tissues excised. The major area of necrosis developed in the left inguinal area some distance from the site of injection. The radiogold was not in a loculation since it had been inserted into the free peritoneal cavity following laparotomy.

The effects of the beta radiation from the radiogold added to the effects of the previous roentgen irradiation might possibly have caused necrosis. This appears to be unlikely, however, since the largest area of necrosis appeared in one of the areas receiving the least roentgen irradiation.

We believe that the major complications in our case can be explained purely on the basis of the surgical procedure. There is a strong possibility that the bowel had suffered previous minor trauma at the time of the third paracentesis, one month prior to the Au-198 instillation. A localized cellulitis developed with abscess formation in the abdominal wall. At the time of the instillation of the radiogold, an abscess cavity was entered and the bowel wall if adherent at this point may have suffered further injury. On the eighth day following the instillation of the radioactive material, a fecal fistula developed.

Massive cellulitis of the abdominal wall due to a gas-forming organism ensued, and necrosis of the abdominal wall developed in two large areas. Grossly, this infection was a type of

* It has been demonstrated that moderate amounts of Au-198 (1.25–1.75 mc./cm.^{3}) can be injected locally without the development of necrosis.[21] Several reports have been published in which the inguinal area was injected with as much as 20 mc. of Au-198 without necrosis.[25–27] In these cases the gold appeared in the skin (4 cm. superficial to the site of injection) twenty-four hours later as a purplish discoloration, but the skin effect did not preclude successful surgery two weeks later (groin dissection).

emphysematous infection that has been described by Meleney.[19]

It was believed that adequate precautions had been taken to avoid surgical complications. Aseptic surgical technic was observed. The radiogold had been sterilized by the supplier according to accepted technics. The abdomen was surgically opened to release loculations and permit equal distribution of the gold. This precaution, however, did not accomplish the desired result of avoiding perforation of the bowel and all of the major complications of "blind" paracentesis with the exception of hemorrhage ensued.

In our opinion intraperitoneal insertion of Au 198 should always be performed through an abdominal incision made in an area remote from large tumor masses and previous incisions due to paracenteses and operative procedures and never through a trochar. This precaution possibly would have avoided the complications that ensued in the case reported here.

SUMMARY

1. Radioactive colloidal gold (Au-198) is our most potent weapon in the management of effusions secondary to malignant disease at this time.

2. Local complications may be divided into surgical complications of insertion, (infection, fistula formation, peritonitis and hemorrhage), complications due to local overirradiation and a combination of these.

3. The first case of gas infection and necrosis of the abdominal wall incident to the surgical procedure of inserting Au-198 intraperitoneally is reported. This case also presented intestinal fistula formation and is the third such case reported.

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If there is no gastrointestinal bleeding, but the duodenal ulcer is invading the pancreas and cannot be excised without possibly producing postoperative pancreatitis, a subtotal gastrectomy can be performed, leaving the ulcer *in situ*. One can remove all mucosa in the pyloric stump and perform a firm closure, expecting that the sutures will hold and thus prevent a duodenal fistula, or closure may be obtained by suturing a catheter into the stump of duodenum and closing the latter around this duodenostomy tube which comes out of a stab wound close to the right costal arch. In such cases there are two tubes coming out of the left side of the abdomen. One decompresses the stomach stump, goes through the anastomosis and comes out of the jejunum a few inches distally. This is connected to a bottle at the bedside for gravity drainage. Another catheter is introduced into the jejunum a few inches distally, and this is for jejunal feeding for a short time. It is also used to receive duodenal juices, by using a small glass tube that connects it with the catheter in the end of the duodenum. Eventually the duodenostomy opening closes after removal of all tubes, and the ulcer heals. (*Richard A. Leonardo, M.D.*)

Metastatic Carcinomatosis Seventeen Years after Radical Mastectomy

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IN general carcinomas are protean and unpredictable, but one tends to use the term "five-year survival" when discussing prognosis. However, occasionally a carcinoma is encountered that does not conform to the usual rules and may recur or metastasize long after the supposed "five-year survival." The clinician must always keep in mind the possibility that a carcinoma may reappear many years after its excision and continually search out this possibility. Long-delayed metastatic recurrence does occur as will be shown in the case reported herein.

Willis,[1] in his monograph on the spread of tumors in the human body, makes the point that long-delayed metastatic recurrence following successful local eradication of the primary growth is by no means a rare occurrence and stresses that this is especially so with mammary carcinoma. He mentions several cases from the literature and some of his own in which metastases occurred at intervals of ten to twelve years after removal of the breast without previous local recurrence. The longest interval was recently reported[2] in a case which presented peritoneal carcinomatosis forty-one years after radical mastectomy, and Davidson[3] reported a case of metastatic breast carcinoma after forty years. Daland[4] reported a case with recurrence thirty-one years after operation, and Steward[5] related a case with recurrence thirty-one years postoperatively. In general most reports consist of several cases of recurrence with intervals of eleven to sixteen years,[6] twenty-three years,[7] or twenty-five[8,9] to twenty-seven years.[10] A review of the standard textbooks on cancer and breast diseases shows only one case report of metastases delayed twelve years after radical mastectomy.[11]

Josephy[7] makes the comment that the five-year period does not mean complete eradication of a breast cancer and that recurrence or metastases may appear much later. There is no time limit to the occurrence of metastatic recurrences but it is evident that the ratio of recurrences decreases in proportion to the time that has elapsed after operation.

The reasons for the tardy manifestations of metastases of any carcinoma are imperfectly understood. Chilko and Quastler[12] made a statistical evaluation of the periods which elapsed between operation and recurrence in breast cancer and found no evidence of qualitative differences between cases with long and short latency. On surveying various groups of their material, they found that usually shorter periods of latencies occurred in cases with rapid preoperative growth, the presence of metastases at the time of operation and manifestations of the metastases in the region of the primary growth. The age of the patient and the histologic structure of the neoplasm did not influence the incidence of late recurrence. A study of cases of breast cancer with delayed metastases compiled from the literature revealed no trait common to all of them.

It is doubtful whether one can determine the degree of clinical malignancy or the rate of metastasis from the microscopic picture of the neoplasm. Kretzler[8] classifies his case of delayed metastasis according to Greenough[13] in group 1 (very low grade malignancy forming metastases only late in its growth, if at all) because there was much differentiation of the cells with a marked tendency to tubular formation. However, Kretzler[8] questions the accuracy of microscopic grading of the degree of malignancy of a neoplasm, as do Ackerman and Regato[14] in their book on cancer. Willis[1] states that when long-delayed metastases appear in a patient in whom there is no local recurrence of the extirpated primary growth, it is clear that

the secondary growth must have arisen from tumor emboli disseminated from the primary growth before its removal. "The neoplastic cells must have lain dormant in the tissues in which they were arrested and their resumption of growth must be attributed to some alteration in the qualities of these tissues or to some release of growth restraints exercised by them on the tumor cells."[1] An interesting light is thrown on late recurrences by a case referred to by Curtis[15] in which at autopsy five years after removal of a breast for cancer, several cancer cells in a quiescent condition, i.e. with no mitoses, were found in the deeper glands of the axilla. The nature of the factors that inhibit local cancer growth or those that produce sudden changes in behavior are unknown at present.

It is being recognized more and more that cancer as a disease is unpredictable. A recent editorial[16] makes note of this and points out that the phenomenon of delayed recurrence has been observed. Ficarra,[17] in the description of his patient who died twenty years after radical mastectomy, states that "this case illustrated the possible presence in some persons of a resistance to cancer." He believes it has to do with "tissue resistance" or pseudoimmunity which allows only the slow progression of the disease.

Gatch and Culbertson[18] also attribute delayed recurrence in breast cancer to tissue resistance to cancer growth.

Gordon-Taylor[19] believes cancer of the breast may recur even many years after operative surgery at a time when the original malady has almost been forgotten, and cites a case of recurrence thirty-one years after initial operation. He states that in some cases recurrence has been preceded by intercurrent disease or by surgical operation for some independent condition.

Morton and Morton[20] point out that cancer may behave as a chronic disease, and summarize seventeen cases, three of which are cancer of the breast with delayed recurrences of ten, sixteen and thirty-one years, respectively. "Sometimes the metastatic cells seem to have remained dormant in the lymph nodes or in the organs of the body without producing symptoms. Sometimes after such a resting period the tumor cells seem to regain their vigor and flare up anew with rapid spread throughout the body."

Dunphy,[21] in his paper on the natural behavior of cancer in man, presents the thesis that "malignant neoplasms undergo periods of spontaneous arrest or regression, alternating with periods of growth and that this phenomenon is a function, at least in part, of local tissue resistance." He states that "the clinical evidence for a natural resistance against cancer is only circumstantial. However, it can be inferred from the development of late recurrences, the regression or arrest of a tumor in one site while it is progressing elsewhere or the occasional explosive spread of cancer." He presents a case of cancer of the breast with metastases accidentally discovered in the appendix, sixteen years after radical mastectomy, during incidental appendectomy while cholecystectomy was being performed. According to him this case provides concrete evidence of the theory that metastatic lesions may remain dormant for years. "The local recurrence of cancer in a scar many years after the original operation is a well accepted observation and provides additional evidence that seeded cancer may be held in check for long periods, presumably by some, as yet unknown, biologic factors." He believes it is meddlesome to employ hormonal agents whose action is unpredictable or at least only palliative until one knows precisely what a given tumor is doing, "especially in metastatic breast cancer which may remain dormant for years without treatment." He believes the use of either estrogens or androgens may activate a lesion that otherwise would have remained quiescent, and that the use of hormones should be restricted to established lesions that are obviously progressive.

CASE REPORT

Patient L. P. (Hospital No. 360845), a fifty-nine year old white woman, was admitted to The Jewish Hospital of Brooklyn for the fourth and final time on March 18, 1952, because of increasing pain in the back, weakness of the lower extremities and difficulty in urination. In 1934 she had had a left radical mastectomy performed at the Lenox Hill Hospital, New York, followed by radiation therapy. A communication from this institution gave the pathologic findings as follows: "Multiple (2) adenocarcinomata of the left breast, grade 2. Metastases in the axillary lymph nodes (left) with tumor emboli in the blood vessels and lymph nodes." The operative note stated that there was extensive lymph node involvement along the

FIG. 1. Lateral radiographic view of dorsal spine.

axillary vessels and it was noted that the prognosis was poor in view of this. Her past history revealed dilatation and curettage for incomplete abortion in 1931, her only pregnancy. Her periods started at the age of twelve and ended in 1941. She had a twenty-eight-day cycle and no menstrual disturbances. Her family history was non-contributory.

Her first admission to the Jewish Hospital of Brooklyn was in 1941 for acute appendicitis, at which time x-rays of the chest, pelvis, dorsal and lumbar spine and extremities were negative for metastatic disease.

She was admitted again on February 25, 1950, because of persistent pain in the left leg and pain in the left axillary region and lower ribs, both anteriorly and posteriorly. There was moderate weight loss due to anorexia. X-rays were repeated and reported as negative except for osteoarthritis of the spine and calcified left subdeltoid bursitis. There was no evidence of metastases anywhere. Her blood count on February 27, 1950, was: red blood corpuscles; 4,740,000 with 90 per cent hemoglobin; the white blood count was 8,500 with 69 polys, 28 lymphocytes and 3 monocytes. The sedimentation rate (Westergren) was 17 mm. per hour. The patient was discharged unimproved on March 26, 1950, with the diagnosis of osteoarthritis of the spine. She received x-ray therapy to the spine for symptomatic relief after she left the hospital.

Her third admission to The Jewish Hospital of Brooklyn was on September 22, 1951, for persistence of pains in the legs, back and more recently, in the left upper posterior rib cage. X-ray investigation of the skeletal system showed osteoarthritic changes with a moderate degree of osteoporosis in the dorsal and lumbar spine, pelvis and left humerus. The skull was negative. The chest x-ray revealed elevation of the left leaf of the diaphragm. There were no metastatic deposits in the lungs or ribs. In the lateral view of the dorsal spine (Fig. 1) there was a semi-circular shadow adjacent to the posterior aspect of the eighth dorsal vertebra; the location of this area corresponded to an area of tenderness over the thoracic spine. Because of this and the progressively increasing pain it was decided to section the intercostal nerves and at the same time explore the posterior mediastinum for a possible infiltrative focus. On October 12, 1951, the sixth, seventh and eighth left intercostal nerves were partially resected. There was a small encapsulated pleural effusion with a thickening of the parietal pleura. A portion of this parietal pleura and a portion of tissue on the lateral wall of the thorax were excised for microscopic study. These were reported as metastatic adenocarcinoma. (Fig. 2.) The sedimentation rate on September 26, 1951, was 50 mm. per hour (Westergren). The red blood count was 4,450,000 with 88 per cent hemoglobin. The white blood count was 10,300 with 64 polys, 10 bands and 26 lymphocytes. There was some relief of pain following this procedure and the patient was discharged October 25, 1951.

The patient was readmitted to the Jewish Hospital of Brooklyn for the fourth and final time on March 18, 1952, with a recurrence of her symptoms in spite of another course of radiation therapy. She appeared emaciated. The left chest was dull on percussion with diminished breath sounds. The right lung was clear and the abdomen was negative. There was marked motor weakness of the left lower extremity and partial motor weakness of the right lower extremity. X-ray of the chest revealed contraction of the parenchyma of the

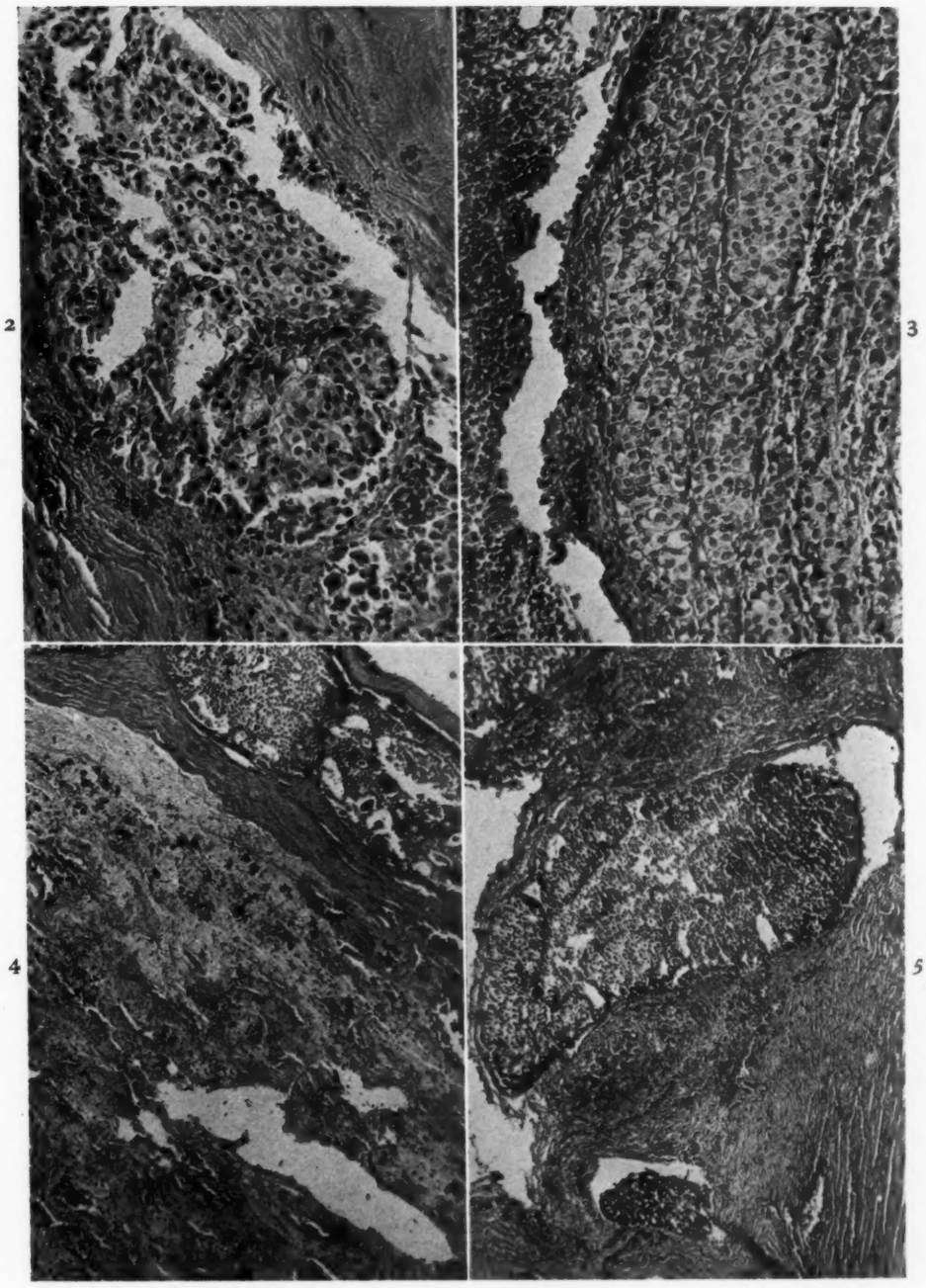

FIG. 2. Photomicrograph of biopsy specimen showing metastatic carcinoma in pleura; hematoxylin and eosin; × 150.

FIG. 3. Photomicrograph showing metastasis in the right axillary lymph node; hematoxylin and eosin; × 150.

FIG. 4. Photomicrograph showing metastic carcinoma within lymphatics in pleura; hematoxylin and eosin; × 150.

FIG. 5. Photomicrograph showing metastases in wall of aorta; hematoxylin and eosin; × 150.

left lung at the base with elevation of the left diaphragm. The right lung was clear. A postoperative defect in the left eighth rib was present. No metastatic deposits in the ribs could be seen. She became progressively more cachectic and died on October 16, 1952, eighteen years after radical mastectomy. During this period of hospitalization the treatment was palliative.

At postmortem examination the left lung was markedly fibrotic and there were metastatic lesions on the pleura and the left diaphragm. The bones in the dorsal and lumbar vertebrae failed to show any metastatic deposits. The thoracic aortic wall showed infiltration by tumor cells. The right axillary node was found to show metastatic carcinoma which was rather unusual in view of the fact that the right breast was uninvolved. Figures 3, 4 and 5 show the microscopic appearance of the metastases. The final diagnosis was (1) metastatic adenocarcinoma involving the left lung and pleura, left diaphragm, wall of aorta and right axillary node; (2) marked fibrosis of left lung; (3) brown atrophy of the heart; (4) marked fibrosis of spleen; (5) congestion of viscera; (6) marked cachexia and (7) generalized osteoporosis.

SUMMARY

A case of metastatic recurrence seventeen years after radical mastectomy is reported. Long-delayed metastases are more likely to occur with mammary carcinomas than with any other type of neoplasm. There is a serious prognostic uncertainty in evaluating carcinoma of the breast.

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The Surgical Management of Benign, Non-calculous Common Bile Duct Obstructions

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THE problem of common bile duct obstruction more often as not resolves into the interpretation and treatment of common duct stone disease or of periampullary neoplastic disease. It is the intention of this report to focus surgical attention upon the less frequently encountered but extremely important group of conditions defining extrahepatic obstruction which is not on the basis of common duct stone or of periampullary new growth. The problems involved are unusual in that they demand careful operative assay of disease and the exercise of surgical manipulations tailored to the tolerance of the patient without the sacrifice of optimum opportunity for relief and/or cure. As in the consideration of stone and malignant disease, common duct obstructions based on other pathologic entities in the extrahepatic biliary tree pose very serious problems in the preparation of the patient and in the planning of the operation.

CASE REPORTS

CASE 1. H. M. (No. 162240), a sixty-eight year old white man, was admitted with a three-month history of anorexia, weight loss of 50 pounds, and moderately severe upper abdominal pain and "bloating." Two weeks before admission jaundice developed and the patient had clay-colored stools. The salient feature on admission examination was a rather marked symmetric enlargement of the right lobe of the liver. Laboratory investigations substantiated an obstructive type of jaundice with an alkaline phosphatase of 33 units and moderate hepatocellular damage evidenced by a bromsulphalein retention of 50 per cent. A gastrointestinal series demonstrated a situation consistent with the tract of a duodenal ulcer which had penetrated into the pancreatic head. On further observation and examination it was thought that in addition to the enlarged liver a tense, insensitive gallbladder was also palpable.

The patient was explored three weeks after admission to the hospital. At operation the gallbladder was markedly distended and contained a few calculi suspended in bile of normal appearance. The common duct was moderately dilated. When the duct was opened, a small, mixed type of calculus floated out. A probe could not be passed down the common duct into its retroduodenal segment. There was obviously a stricture of this portion of the duct and on careful study the stricture was demonstrated to be contiguous in origin with the duodenal disease present. The duodenum was extensively scarred and an ulcer crater was palpable in the posterior bulb directly within the head of the pancreas. Common duct occlusion here was secondary to cicatrization from an ulcer which some time in the past had penetrated or perforated into the pancreas. In addition, the liver was diffusely enlarged and finely nodular.

Despite the presence of stone, it was apparent that the more serious disease involved an obliterative stricture of the supra- and retroduodenal portions of the common duct. Following demonstration of the patency of the cystic duct and the absence of a cystic duct calculus, the distended gallbladder was opened, the stones were removed and the simplest decompressive procedure was selected. Consequently, a cholecystoduodenostomy was performed to by-pass the stricture. A small French catheter was sutured into the common duct. A liver biopsy was taken. The latter exhibited "chronic and acute hepatitis." There was some bile suppression for several days following operation, during which period the patient was moderately lethargic. Thereafter he convalesced rapidly. Cholangiographic study done three weeks after operation demonstrated narrowing of the common duct distally, the absence of non-opaque filling defects and immediate filling of the duo-

denum through the gallbladder anastomotic site.

This patient was last examined eighteen months after operation. There had been no jaundice, chills or fever. His gastrointestinal complaints were minimal. On examination the liver was still enlarged and slightly tender.

Comment. Common duct obstruction due to progressive ulcer disease has been well recognized[1] and unquestionably is one of the least commonly encountered causes for obstructive jaundice. Here the readily demonstrated obstruction was on the basis of endocholedochal or of pericholedochal obliteration of the lower end of the common duct due to residual cicatrizing effects of a posterior wall duodenal ulcer which had perforated into the pancreas.

This case reflects the urgency for individualization of every problem involving common duct obstructive mechanics. Although a few discrete calculi were present in the distended gallbladder and common duct, inflammatory changes were not exhibited and the gallbladder was of the true Courvoisier type with cystic duct patency. Liver damage was estimated as extensive. The patient had never been on a controlled medical ulcer regimen. Consequently, the simplest effective maneuver was resorted to in surgically decompressing the obstructed biliary tract, namely, cholecystoduodenostomy.

In such a situation it was deemed inadvisable to remove the calculous gallbladder and to chance the effectiveness of a by-passing procedure involving lateral anastomosis or direct implantation of the common duct into the intestinal tract. Decompressive choledochoduodenostomy, a popular procedure among European surgeons,[29] has not been widely practiced in America because of the incidence of subsequent complications due to stenosis or intestinal reflux, or both.

Case II. M. G. (No. 160464), a seventy year old white woman, was admitted to the hospital because of intermittent right upper quadrant pain of one year's duration and weight loss of 30 pounds during the six months antedating hospitalization. On examination the patient appeared somewhat icteric and the liver was moderately enlarged. Laboratory investigations indicated an obstructive type of jaundice. The patient was explored one week after admission to the hospital. A chronically diseased gallbladder containing stones was removed. The dilated common duct was explored and a firmly impacted calculus was identified in the lower end of the duct. Because the stone could not be delivered from above, the duodenum was mobilized by dissecting the right colic flexure downward and by incising the right lateral peritoneum permitting of reflection of the duodenal loop to the left. Thereafter the stone was readily manipulated cephalad into the choledochotomy incision. A small T-tube was placed in the original choledochotomy incision. A choledochogram taken on the sixteenth day demonstrated some symmetric narrowing at the ampulla. No opaque calculi were visualized. The patient was discharged with the clamped-off T-tube *in situ*. Two weeks later she noted some oozing of bile about the tube and her stool became clay-colored.

The patient was readmitted to the hospital five weeks after the original procedure. She was now moderately icteric and she gave a poor impression clinically. The liver was markedly enlarged and somewhat tender. The liver profile tests indicated progressive obstructive jaundice and a rather marked degree of hepatocellular damage; (bromsulphalein excretion 88 per cent retention, and cephalin flocculation test 4 plus). On repeat cholangiogram no opaque calculi were visualized, but again there was suspicion of obstruction at the ampullary level. The patient was vigorously treated in ensuing weeks by T-tube decompression, intravenous alimentation and diet.

Four weeks after the second admission she was reexplored through the original incision. The duodenum again was reflected to the left as a page in a book. On careful palpation there was no evidence of tumor at the papilla. The common duct was opened and the right and left hepatic ducts were instrumented with negative findings. A catheter passed readily to the ampulla but not through it. A small probe was inserted and this did not traverse the ampulla. Duodenotomy was then performed, and by means of the combined approach the area under question was explored. A stricture at the ampullary end of the common duct was identified. The sphincter of Oddi was then divided anteriorly under direct vision over a grooved director. Following this maneuver a No. 18 French catheter was very easily passed from above through the ampulla into the duo-

denum. The catheter end was left in transvaterian position and the bell end was brought out through the original choledochotomy incision. Biopsy of the enlarged liver subsequently was interpreted as "cirrhosis."

Postoperatively the catheter drained a large amount of bile-stained fluid which was very likely duodenal in origin. Temperature spikes to 102°F. were interpreted as due to cholangitis. It had been intended that the tube be left through the papilla for four to six weeks. However, the tube came out spontaneously two and a half weeks after operation. Thereafter the patient's stools were brown. Convalescence was uneventful and she was discharged one month after the secondary procedure. When last seen seventeen months following sphincterotomy the patient had remained well. She had gained 25 pounds and was symptom-free. There have been no manifestations of obstructive jaundice or hepatic insufficiency.

Comment. This case illustrates another uncommon yet classical type of obstruction of the common duct, namely, stricture secondary to ulceration produced by an impacted stone in the lower end of the common duct. The stricture was demonstrated to be terminal in location and confined in limit. It was readily accessible to a logical measure of surgical therapy to decompress the obstructed biliary tree. Section of the lower end of the common duct through the sphincter was effective.

The enormous advantage to be obtained in interpretation and treatment by the combined transcholedochal and transduodenal approach[19] is well substantiated in this instance.

Case III. M. M. (No. 23946), a forty-nine year old man, experienced upper abdominal pain, pruritus and an episode of chills and fever six months following cholecystectomy. At the original operation a recognized rent had been made in the common duct following application of a clamp for vigorous bleeding; the rent had been sutured. Eight months after operation the patient was readmitted to the hospital, and on study there was evidence of jaundice and moderate parenchymatous liver damage.

The patient was explored with the possibility of common duct obstruction in mind. Extensive adhesions below the porta hepatis were separated and the common duct was visualized and was noted to be somewhat dilated. On careful inspection there was no evidence of stricture or of defect at the site of cystic duct junction, or at the previous lateral suture line of the common bile duct. No tumor or calculus was identified. The possibility of intermittent obstruction due to extensive postoperative adhesions and angulation of the duodenum under the right lobe of the liver was entertained. The common duct was not explored transcholedochally. Following operation the pruritus disappeared and the stools were brown.

One month after this procedure itching and sporadic jaundice returned. Two months after the second operation the patient experienced a chill and he was readmitted to the hospital for re-exploration. The common duct was readily exposed. No calculus was palpable and no tumor was identified. Just below the junction of the two hepatic ducts there was now a definite cicatricial stricture with a bulbous dilation above. The common duct was opened at a considerable distance below this stricture. On instrumental exploration the papilla was identified as normal. The hepatic duct system above could not be probed upward because of the stricture. The stricture was carefully exposed by sharp dissection, and transverse resection was performed; this involved removal of approximately 1 cm. of common duct. The normal duct ends were reconstructed by direct suture over a No. 14 French catheter. The end of the catheter was passed through the papilla and into the duodenum and the exploratory opening in the common duct was closed.

Postoperatively the jaundice cleared rapidly and the stools were brown. The patient was discharged from the hospital two weeks after operation. The catheter was passed shortly thereafter. When last heard from four years after the last operation the patient had remained entirely symptom-free without any manifestations of further biliary tract obstruction or of hepatic failure.

Case IV. E. G. (No. 68342) was a fifty-one year old white man upon whom cholecystectomy had been performed incidental to resection of a locally infarcted segment of greater omentum during operation for an acute surgical condition of the abdomen. The gallbladder removal had been accomplished with considerable technical difficulty; vigorous bleeding had occurred. Postoperatively a complete biliary fistula developed through the drain site.

Three weeks after the initial procedure the patient was explored. The common duct was represented by a long and anatomically func-

tionless fibrosed strand. After a one and a half hour exploration during which the entire right hepatic artery was dissected, a small bulbous swelling was encountered just within the liver hilum from which bile could be aspirated. This represented the point of junction of the right and left hepatic ducts. Despite extensive mobilization and elevation of the duodenal loop and the head of the pancreas, a primary end-to-end suture was completely out of the question in the consideration of reconstructive efforts. A Roux-en-Y hepaticojejunostomy was planned. However, the patient's condition was precarious and a simpler and quicker type of by-passing maneuver was regarded as imperative in this instance. Consequently, a direct hepaticoduodenostomy was carried out over a No. 16 French catheter. The bell end of the catheter was held snugly in the opened junction of the two hepatic ducts proximal to the suture line and actually within the liver. The distal end of the catheter was left protruding into the duodenum. The postoperative course was stormy although bile appeared in the gastric washings on the very first day. Profuse bile drainage to the outside continued for two weeks and then gradually reduced. Following this, stools were brown and the patient started to gain.

Four and a half months after the reconstruction the patient vomited up the tube which had been used as a stent. Thereafter he did well and has remained symptom-free since operation for relief of a total biliary fistula. When last heard from five years after operation he had had no chills, fever, jaundice or unusual gastrointestinal complaints.

Comment. These two cases of surgical stricture of the common duct illustrate the most serious problems encountered in non-malignant common duct obstructions. Obstructions of the common duct as exhibited here invariably reflect technical difficulties encountered at primary cholecystectomy. Recognition and operative reconstructive efforts are mandatory at the earliest possible date in order that the patient be spared the all too familiar unfortunate and progressive disabilities of the biliary tract cripple. The evolution of the technical practice of gallbladder surgery has revolved largely about lessons learned from surgical strictures of the common duct. The possibilities of anatomic variation in the virgin areas of the gallbladder, of the duct systems and of the vascular trunks are legion.[12]

The methods of repair of strictures are dependent entirely upon the anatomy encountered and upon the surgeon's particular preference in this field of endeavor. In earlier years ingenious but futile efforts were made to transplant the tracts of total external biliary fistulas back into the bowel.[14] Direct methods of approach were evolved using grafts of analogous tissues.[4,11] Eventually the type of repair utilizing stents of many varieties became popular. In some technics the tube stent has been brought to the exterior through an independent aperture in the upper small intestinal tract.[6] Stents involving the use of foreign bodies have been composed of a variety of inert materials including glass, rubber,[28] Vitallium®[23] and plastics.[2] The stent frequently migrated or became a nidus for subsequent sludge and stone deposition.[24]

In any reconstructive procedure it is granted that a direct end-to-end anastomosis is the most desirable and has withstood the test of time. In the past this has been regarded as being possible only in rare instances because of the length of duct involved in the stricture. Nevertheless, it is sometimes possible following extensive mobilization and dislocation of the pancreaticoduodenal loop upward that rather large defects can be bridged and the new position maintained. The Lahey Clinic group[15] and others have stressed the importance of preservation of the ampullary sphincter with preliminary pancreatic split to dissect the preserved lower end of the common duct. This is very difficult and raises the possibility of injury to the main pancreatic duct in its course paralleling the common duct for a significant distance before it terminates. The Mayo group[30] have not been as impressed with the preservation of sphincter and have long performed a simple type of direct reimplantation of proximal duct into the intestinal tract. With the latter method subsequent complications of chills and fever, and jaundice and equivalents have been said to arise because of retrograde admission of intestinal contents. Thus has the Roux-en-Y type of diversionary choledocho-enterostomy become very popular. However, the evidence seems to indicate that it is rather an anastomotic stenosis with obstructive changes which is more to be feared than a widely patent choledocho- or hepaticoenteric stoma.

There is no stereotyped approach to the

problem of post-traumatic stricture or to that of the rare stricture which is secondary to chemical and infectious cholangitis or pericholangitis. Repeated operations for stenotic obstruction of the common duct at the sites of new stomas are frequently necessary. At each successive endeavor the problem is much more involved and exasperating than the previous one. Very soon no hilar strictures are available. Serious consideration must be given to the development of the approach of Longmire.[16] He isolates a hypertrophied duct from a partially resected left lobe of the liver and anastomoses this to the small bowel in Roux-en-Y fashion. To decompress the entire biliary tree an adequate hilar communication between right and left hepatic ducts is desirable.

Case v. M. M. (No. 162303), a forty-two year old Puerto Rican woman, had been operated upon for acute cholecystitis six years prior to the present admission. At the initial operation an acutely infected gallbladder containing multiple calculi had been removed. The common bile duct had not been explored at this procedure. Several weeks after operation the patient began to experience serial attacks of right upper quadrant pain approximately two times a month, each such attack lasting several hours. These episodes continued until the time of the present admission. Several weeks before, the patient was said to have had temperature and transient jaundice.

At the time of admission the patient was neither jaundiced nor febrile. There was slight tenderness in the right upper quadrant. Although the serum bilirubin level was at the upper limits of normal, the alkaline phosphatase was 14.7 mg. per cent. The serum diastase reading was 62 units. Although there was a question of considerable psychoneurotic overtone to her complaints, she was explored because of the possibility of a long-retained common duct stone.

At operation the common duct was somewhat dilated. It was enveloped by several enlarged, soft lymph nodes, one of which was biopsied and demonstrated to be "chronic lymphadenitis." The right hepatic artery was anterior to the common duct. The liver was not unusual on gross examination. The pancreas at the region of the papilla seemed slightly thickened. Following opening of the common duct no calculi were identified on careful instrumentation and irrigation. However, it was impossible to insert a probe beyond the ampulla into the duodenum. Consequently the duodenum and the head of the pancreas were mobilized from the retroperitoneal position. A duodenotomy incision was made and the papilla identified. Spastic or fibrotic stenosis at the sphincter level was clearly demonstrated. An anterior sphincterotomy was made over a small grooved tool as a guide. A Cattell tube was inserted with the long arm of the T-tube extending through the sectioned papilla into the duodenum.

Postoperatively the patient ran a febrile course and vomited occasionally for a week. There was rather profuse drainage, much of which was probably duodenal in origin, through the T-tube. A gastrointestinal series done on the nineteenth postoperative day exhibited no startling changes beyond "edema and duodenitis." A choledochogram taken three weeks after operation demonstrated an entirely normal extrahepatic duct system without evidence of calculi. At this time the tube was extracted and the patient's condition improved significantly. She was discharged four weeks after operation.

This patient was examined six months after operation. Although she offered upper gastrointestinal complaints, she was decidedly improved symptomatically and had gained 16 pounds in weight since her operation.

Case vi. A. A. (No. 33204), a fifty-seven year old white woman, presented a two and a half year history of attacks of boring upper abdominal pain which always radiated to the back and was occasionally relieved by induced vomiting. These attacks were not triggered by any known mechanism and each one generally lasted eight to ten hours. On x-ray study the patient had a poorly emptying type of gallbladder containing stones. She was a known hypertensive of some twenty years' duration with a blood pressure generally of about 180/100. The patient's cardiologist indicated that there was no anginal component in her pain symptomatology. On physical examination findings were not remarkable except for hypertension and the elicitation of deep right upper quadrant tenderness. A preoperative blood amylase was not requested.

On exploration the gallbladder was chronically diseased and contained numerous small calculi. The cystic duct was moderately dilated and no impacted calculi were present. The

entire head of the pancreas incorporated in the duodenal loop was nodular, spongy and diffusely enlarged.

Because of the striking pancreatic disorder and because of dilation of the cystic and common ducts in the presence of small gallbladder calculi, the common duct was explored after the gallbladder had been removed. It was impossible to pass an instrument through the papilla. Exploration was further carried out by mobilization of the duodenum from its retroperitoneal position, and thereafter an anterior duodenotomy incision was made. Confirmation of a markedly stenotic sphincter was established under visual manipulation. Anterior sphincterotomy was then performed with an incision carried well through the ampullary fold of the mucous membrane. A soft, fenestrated No. 16 French catheter was then left projecting into the duodenum; the proximal end was led out of the choledochotomy incision.

Postoperatively there was vigorous drainage through the catheter. The tube was clamped off on the tenth postoperative day and was extracted on the twelfth postoperative day. The course thereafter was punctuated by severe spreading parotitis which necessitated operative incision and drainage because of progressive facial nerve paralysis. She was discharged five weeks after operation.

Eventually she was placed on an unlimited diet. There has been no recurrence of abdominal symptoms during the three and a half years since operation. The patient recently suffered a cerebrovascular accident from which she was recovering when last heard from.

Comment. These final two patients are presented jointly because they are illustrative of common duct obstructions which possibly are etiologically closely associated.

The first case is one of spastic and/or fibrotic stenosis of the sphincter of Oddi occurring in a woman with persisting symptoms following removal of a calculous type of gallbladder some five years previously. This clinical sequence of events has plagued all surgeons and fortunately does not occur in more than 10 per cent of the patients in whom cholecystectomy is performed for cholelithiasis. The situation is considerably more serious in the cholecystectomized patient without stones, of whom an estimated 40 to 50 per cent are unrelieved of the upper gastrointestinal symptom complex.[3] These patients are categorized in the descriptive "wastepaper basket" of biliary dyskinesia. The etiologic concepts proposed in interpretation of the latter condition have variously included gastric hyperacidity with or without peptic ulceration, hiatal hernia, psychoneurosis and cystic duct stump disease in the nature of inflammatory and stone progression[8] or of stump neuroma formation.[32] The interpretation frequently reflects physiologic validity in terms of chronic progressive or chronic recurrent pancreatitis triggering or maintaining a cycle of sphincteric spasm with consequent endocholedochal hypertension.

Because of the anatomic exhibition of ampullary stenosis in association with chronic pancreatitis in the second of these patients, it was deemed advisable to perform a sphincterotomy in addition to treating the disease of the upper biliary tract.

Chronic pancreatitis is decidedly not an uncommon disease. Preoperative investigation of this ailment is difficult. The serum amylase reading is of no aid except during certain phases of the acute attack. The patient with chronic recurrent or intermittent pancreatitis may never show an elevated amylase on study. Secretin studies are difficult of performance, are expensive and are not standardized in interpretation. Pancreatitis is a surgical entity which must be interpreted in terms of the entire picture at the operating table.

It has been well documented experimentally in animals[17] and in man that pancreatitis physiologically results from a combination of mechanisms enforcing an increase in parenchymatous secretory activity against relative obstruction of the duct outflow tract. There is probably no single etiologic concept befitting this combination of events. Disease in the gallbladder may set up a reflex cycle initiating spasticity of the sphincter. Probably a few cases of chronic recurrent pancreatitis are adequately handled by cholecystectomy alone by the elimination from contact with the delicate sphincter of abnormal gallbladder bile which is physically viscid[7] or chemically altered. The "common channel" concept was classical in its surgical exhibition by Opie in 1901 in an autopsied case, and by his experimental production of pancreatitis with bile injected into the pancreatic duct.[21] Where a small, obstructing ampullary stone causes retrojection of bile into the pancreas, extraction of said stone will control the disease. However,

the "common channel" concept is anatomically not as widely applicable as was interpreted. It is known that in a significant number of instances the common bile duct and the main pancreatic duct are conducted to the duodenal ampulla independently and are separated by a septum. However, it is significant that in these latter instances the two structures share the sphincter in common, which structure may obstruct either or potentially both duct systems. The sphincter mechanism is said to be sensitive to changes in the chemical constitution of the bile, to biliary tract infection, autonomic system overtone, gastric acid and other physiologic mechanisms which might initiate or sustain a spastic cycle of events.

Therapeutic endeavors in our armamentarium to treat chronic pancreatitis have included gastric resection or vagectomy to reduce acid, sympathectomy to relieve pain and possibly duct sphincter spasm,[20] and sphincterotomy.[5] In addition various procedures have been designed to by-pass secondarily the diseased head of the pancreas and spastic sphincter and thereby to decompress the pancreaticobiliary hypertension. These procedures have included side-to-side choledochoduodenostomy and Roux-en-Y choledochoenterostomy.[2,22]

It is possible that further experience may demonstrate that sphincterotomy under vision is an effective and simply performed surgical procedure to decompress the duct system. This is a far from new concept in the management of chronic pancreatitis. Indeed, in a monumental surgical essay in 1919, Archibald,[1] on the basis of his extensive experiments demonstrating the role of sphincter resistance, concluded as follows: "In the chronic sclerosing type of pancreatitis . . . I believe on theoretical grounds that it would be wise to cut the sphincter of Oddi in order to make quite sure that there will be no interference with the easy exit of bile."

REMARKS

Preoperatively many of these patients are in a precarious condition at best. Some have undergone one or several extensive operative procedures previously. Liver reserve has more frequently as not been desperately exhausted by long periods of biliary stasis, by parenchymatous cessation of function and eventually by a cirrhotic type of replacement. Tissue protein destruction, manifest by considerable weight loss, is inevitable due to chronically draining tracts, to total loss of appetite secondary to liver dysfunction, and sometimes to loss of bile constituents and fluid because of fistulous diversion to the outside. These individuals require detailed preoperative preparation to reverse the systemic state of "chronic shock" and to restore liver function for the estimated demands of long anesthesia and surgical manipulation.[25]

On the other hand, a plea is made not to "study the patient to death" with prolonged observation and repeated batteries of liver profile tests once the situation is obvious. From the surgical point of view icterus in the presence of acholic stools, bile pigments in the urine and an alkaline phosphatase level of over 10 mg. per cent in any combination cannot be denied as evidences of extrahepatic block. Retrograde suppressive effects on the parenchyma occur within a matter of days in common duct obstructions. The surgeon is shortly furnished with positive "function" tests among which the cephalin flocculation study and the bromsulphalein retention might seem to be as exclusively reliable as any of the multitude at our disposal. In extrahepatic biliary tract obstructions hepatocellular failure can never be reversed until the cause is surgically rectified and the period of preparation is judged accordingly.

The incision is fashioned to the configuration of the patient, to any lesson learned from a previous operation on the same patient and to the preference of the surgeon by practice. Long rectus muscle-splitting incisions, subcostal oblique or transverse incisions with extension toward the loin if necessary and variants of a costal arch extrapleural chest wall flap have been utilized; an occasional preference has been encountered for the combined right-sided thoracoabdominal approach to the porta hepatis.[26] Careful mobilization of the duodenal loop and the head of the pancreas from the right retroperitoneal bed is mandatory for interpretation of the pathologic condition and for treatment. The Kocher maneuver is preceded by section of the right colic flexure attachments to the liver and right gutter, thus making possible the caudad dislocation of the hepatic flexure of the colon. Few surgeons are now hesitant about opening the duodenum for combined transcholedochal-transduodenal assay of the disease process. Duodenal fistula

does not occur following careful retroduodenal dissection and adherence to principles of small bowel layer suture.

Operative cholangiography, a practice regarded with varying enthusiasm in common duct problems,[13,27] was not resorted to in these cases; nor have we employed it routinely in interpretation of stone disease at the operating table. The margin of possible error in the sense of both false-negative and of false-positive studies has precluded general acceptance of routine operative cholangiography. However, refinements are constantly being made such as those suggested recently in the nature of utilizing an operating table with a plastic, radiolucent center to accomodate the x-ray tube below the table; small casettes in sterile covers are placed directly over the duodenum.[10]

There is unquestionably a tendency to reduce the use of rubber tubes in common duct work. Long, stiff, tightly fitting T-tubes are being replaced by small, straight French catheters if the purpose is for decompressive common duct drainage. It is agreed that in the reconstructive procedures the period of healing in mucosa-to-mucosa fashion is prolonged in the presence of bile stasis, avascularity and infection. However, there is strong suspicion that after a period of six to eight weeks the stent tube has outlived its usefulness in its position at a common duct or intestinal suture line and thereafter may well act as a foreign body. Indwelling tubes are violently rejected eventually in tissues everywhere and it is apparent that the biliary tract is no exception. There are experimental considerations suggesting that these mechanical agents may eventually prove superfluous in reconstructions in the biliary tract.[18] It is not meant to leave the impression that a lateral exploratory choledochotomy incision, suture of which can never water-seal the duct as occurs in blood vessel suture, should not be drained with a small catheter.

The precise indications for sphincterotomy have yet to be crystallized and this operation is selected at the discretion and experience of the surgeon. It is to be emphasized that this procedure is best performed by the combined transcholedochal and transduodenal routes rather than by blind instrumentation alone. In the cases cited herein sphincter section has been performed readily and under control by incising the papillary structure precisely anteriorly over a grooved director. No attempt is made to suture each of the opposing lips of the sectioned papilla; the sphincter edges conveniently spring apart, and with interruption of the sphincter fibers, subsequent bridging-cicatrization and stenosis are highly unlikely. In addition, attempts at mucosa-to-mucosa suture of the respective sectioned edges might damage or incorporate the terminal duct of Wirsung which in this region may exactly parallel the common duct course in the pancreatic head.

CONCLUSION

The treatment of the benign, non-calculous common duct obstruction is illustrated by conditions present in six operated cases: (1) common duct stricture due to a penetrating duodenal ulcer, treated by cholecystoduodenostomy; (2) stricture of the ampullary end of the common duct following removal of a common duct stone at a previous operation, treated by sphincter section; (3) surgical stricture of a segment of the common duct, treated by excision and end-to-end suture; (4) surgical cicatrization of the entire common duct, treated by hepaticoduodenostomy; (5) biliary dyskinesia on the basis of hypertonicity or fibrosis of the sphincter of Oddi, treated by sphincterotomy; and (6) ampullary obstruction of the common duct due to chronic pancreatitis, treated by sphincter section.

The etiologic concepts and the therapeutic possibilities in each type of common duct obstruction documented are elaborated upon in detail, and a discussion on experiences in surgical preparation and on some technical details is presented.

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A Review of 250 Thyroid Operations

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THE purpose of this paper is to review 250 cases of thyroidectomy performed at Jackson Memorial Hospital between the years of 1948 and 1953 in an attempt to analyze and correlate the various factors involved. The hospital is similar to a county hospital, having both private and staff patients. The surgery in this series was performed both by attending men and the resident house staff.

TABLE I
PREOPERATIVE DIAGNOSIS

Non-toxic solitary adenoma	99
Non-toxic adenomatous goiter	40
Colloid goiter	15
Diffuse toxic goiter	55
Nodular toxic goiter	20
Thyroiditis	2
Carcinoma	1
Previous thyroid surgery (diagnosis now):	18
Non-toxic solitary adenoma	5
Non-toxic adenomatous goiter	4
Diffuse toxic goiter	3
Nodular toxic goiter	4
Thyroiditis	1
Carcinoma (previous biopsy)	1

Of the 250 patients, 189 were private and 61 were staff. There were 238 females with an average age of 41.7 years and a range between eight and seventy-eight years. There were twelve males whose average age was 46.2 years with a range between twenty-nine and sixty-four years. There were 210 white patients, thirty-nine Negro patients and one Indian.

Preparation was difficult to evaluate as this information was not available in all cases. In the cases available for study the form of preparation most generally used was propylthiouracil in a daily dosage of 200 to 400 mg. until a euthyroid state was obtained and in addition, Lugol's solution, ten drops daily for the last two or three weeks prior to surgery.

The most common presenting complaint in the non-toxic patients was of a mass in the neck present for a period of time varying from several months to twenty years. The toxic patients showed many symptoms present in varying degrees of severity. Among these were increased nervousness, irritability, tremor, heat intolerance, loss of weight with increased appetite, palpitation, insomnia, exophthalmus and tachycardia. The patients with thyroiditis most commonly showed a symmetric enlargement of the neck without thyroid dysfunction. The patients with carcinoma presented little in the way of symptomatology to indicate the malignant nature.

TABLE II
PATHOLOGIC DIAGNOSIS

Non-toxic solitary adenoma	103
Follicular:	78
Embryonal	6
Fetal	44
Simple	14
Colloid	12
Hürthle cell	2
Papillary	16
Unclassified	2
Mixed	7
Colloid goiter	12
Diffuse toxic goiter	40
Toxic nodular goiter	24
Thyroiditis:	16
Hashimoto's struma	12
Reidel's struma	2
Mixture	2
Carcinoma:	5
Papillary adenocarcinoma	5
(Positive nodes)	2
Adenomatous goiter with thyroiditis	7
Normal gland	1
Organizing hematoma	1

The operative evaluation of the 250 patients in this series rated 211 as good to excellent operative risks. Thirty-eight were rated as fair to good operative risks because of the findings listed in Table III.

One patient was rated as a poor operative risk due to marked tracheal deviation from a substernal goiter with hypertensive cardiovascular disease, functional classification IV.

In general, preoperative medication consisted of a barbiturate on the night before surgery with $\frac{1}{6}$ gr. of morphine and $\frac{1}{150}$ gr. of

hyoscine for the average male and 1/8 gr. of morphine and 1/200 gr. of hyoscine for the average female, with half an ampul of bellafoline used in addition during the last year as a preoperative hypodermic approximately one hour before surgery. The type of anesthesia and the various operations performed in this series are listed in Tables IV and V.

TABLE III

Bronchial asthma	3
Hypertensive arteriosclerotic heart disease:	8
Functional classification II	4
Functional classification III	4
Marked toxic symptoms:	13
Toxic thyroid heart disease	6
Functional classification II	4
Functional classification III	2
Substernal goiter:	5
Confirmed at surgery	4
Additional found at surgery	2
Arrested tuberculosis	2
Rheumatoid arthritis	1
Pregnancy (two months)	1
Tertiary syphilis (recently treated)	1
Chronic laryngitis	1
Senile emphysema	2
Left vocal cord paralysis (pressure)	1

TABLE IV

Pentothal® induction with cyclopropane maintenance	168
Pentothal induction with nitrous oxide maintenance	18
Various inhalation combinations	17
Local (½ per cent novocain®)	37
Local plus inhalation agent	7
Local plus pentothal	3
Endotracheal anesthesia	25
Avertin® used as a basal anesthetic:	33
Local	7
General	26

A drain was used postoperatively in 219 cases for an average period of 1.4 days.

A patient was considered febrile if on any day following, but not including, the day of surgery the temperature was 100°F. or above. Of the patients on no antibiotics, 113 were febrile for an average duration of two days, while forty-nine were afebrile. Of those patients placed on antibiotics (usually penicillin, either of the aqueous or later of the long-acting type) immediately following surgery, fifty-eight patients were febrile for an average period of 2.8 days. Not including six patients in whom the antibiotics were continued for definite reasons, there were fifty-two patients who were febrile for an average period of 2.2 days. Twenty-five of the patients placed on antibiotics immediately following surgery were afebrile. There were five patients not originally on antibiotics who, because of a complication, were later placed on antibiotics. They were afebrile in an average time of two days.

TABLE V

Operation Performed	No. of Cases	Operating Time (min.)	Hospital Days
Bilateral subtotal thyroidectomy	136	95	6
Right subtotal thyroidectomy	27	70	4.8
Left subtotal thyroidectomy	26	75	4.2
Right total thyroidectomy	4	101	5.5
Left total thyroidectomy	5	78	4.2
Excision of adenoma	52	55	4

Complications resulting from thyroidectomy are listed in Table VI.

During the intubation of one of the patients, which was done after the thyroid had been exposed, the trachea was perforated by the stylet. The perforation could not be found and the wound was closed with drainage. The patient showed no ill effects and was afebrile throughout the hospital stay.

Five cases of carcinoma were discovered during this series:

1. A forty-two year old white man with a solitary nodule which had been removed two weeks previously and reported as a papillary adenocarcinoma had a left radical neck dissection with a left total thyroidectomy performed.

2. A fifty-nine year old white woman with a preoperative diagnosis of toxic nodular goiter was found to have papillary adenocarcinoma. No nodes were noted at surgery and the patient was given no postoperative irradiation.

3. A fifty-nine year old Negro woman with a preoperative diagnosis of a solitary nodule and a pathologic diagnosis of papillary adenocarcinoma had a subtotal thyroidectomy and was given deep x-ray therapy postoperatively.

4. A twenty-eight year old white woman with a preoperative diagnosis of a solitary nodule was found to have papillary adenocarcinoma with metastases to the regional nodes.

5. A sixty year old white woman with a preoperative diagnosis of a solitary nodule was

TABLE VI

Complications	No.	Total	Remarks
Death	1	..	A 78 yr. old white woman who had what was thought to be pulmonary infarction on the 9th postoperative day, and with poor response to therapy, died on the 26th postoperative day; no autopsy
	1	2	A 70 yr. old Negro man started fibrillating on the evening following surgery; 1 hr. later he suddenly became dyspneic and died; autopsy showed a massive hematoma in the operative site extending from the pharynx to the pericardium; he also had syphilitic aortitis with aneurysmal dilation of the ascending aorta; cause of death was thought to be the additional anoxemia caused by the hematoma
Respiratory difficulty:			
Tracheotomy postoperatively	1	..	Toxic case performed on the evening following surgery; removed on the 6th postoperative day
	1	..	Toxic case performed on the day following surgery; difficulty due to complete left and partial right vocal paralysis; removed on the 19th postoperative day; right cord returned to normal but left cord remained paralyzed
Marked hoarseness	5	..	
Severe cough	4	..	
Wound edema	1	..	
Postoperative laryngoscopy on the first postoperative day revealed normal cord movements	1	13	
Toxic symptoms postoperatively:			
Placed on Lugol's solution	7	..	
Discharged on itrumil®	5	..	
Digitalized postoperatively	4	..	
Violent anesthetic recovery	1	..	
Toxic myocarditis	1	18	
Calcium deficiency	..	2	Required intravenous calcium gluconate and para-thormone®; both recovered before discharge
Persistent nausea and vomiting	..	3	
Wound edema:			
Hematoma requiring reopening of incision for drainage	3	..	
Drain used after surgery	2	..	
Drain not used after surgery	1	8	
Aspiration pneumonitis	..	2	
Atelectasis	..	1	
Myxedema	..	2	Placed on thyroid daily postoperatively
Circulatory collapse	1	..	Patient had a marked fall in blood pressure postoperatively; responded to levophed®; no evidence of infarction; recovered completely in one day, with no residual effects
	1	2	Patient had a proved myocardial infarction on the 3rd postoperative day; responded well to routine therapy

found to have papillary adenocarcinoma on pathologic examination.

OBSERVATIONS

1. In the 250 cases there were two deaths with an operative mortality of 0.8 per cent and postoperative complications in forty-eight other cases.

2. There were five cases of carcinoma, one of which was suspected preoperatively, for an incidence of 2 per cent. There were 109 cases of solitary nodules with carcinoma discovered in four for an incidence of 3.39 per cent and twenty-four cases of toxic nodular goiter with carcinoma discovered in one for an incidence of 4.15 per cent.

3. Of the patients operated on, 328 were females and twelve were males.

4. There were eighty-two cases diagnosed

clinically as toxic, with sixty-four confirmed pathologically.

5. There were eighteen cases with previous thyroid surgery. Of these, ten were now non-toxic and seven were toxic, with one having had a previous biopsy which proved to be a carcinoma.

6. A non-toxic solitary adenoma, seen in 104 cases, was the most frequent reason for thyroid surgery.

7. Two hundred eleven patients were rated as good to excellent operative risks. Of these there was one death, which in retrospect was not correctly evaluated. There were thirty-eight fair to good operative risks with no deaths, and one poor risk expired twenty-six days postoperatively.

8. The most frequent anesthesia used was a pentothal induction with cyclopropane maintenance in 168 cases. Endotracheal anesthesia was used in twenty-five cases and local anesthesia was used alone in thirty-seven cases.

9. The most frequent operation was bilateral subtotal thyroidectomy in 136 cases with excision of an adenoma alone done in only fifty-two cases.

10. The average operating time was seventy-nine minutes with the average hospital stay being 5.1 days. This varied from an average stay of six days for the patients who underwent subtotal thyroidectomy to four days for those with excision of an adenoma.

11. Of the 162 patients on no prophylactic antibiotics, 113 were febrile for an average period of two days and forty-nine were afebrile. Of the seventy-seven patients on prophylactic antibiotics, with no complications requiring continuance of therapy, fifty-two were febrile for 2.2 days and twenty-five were afebrile. Five cases were placed on antibiotics later and were afebrile in an average period of two days.

12. A postoperative wound drain was used in 219 cases for an average period of 1.4 days. Of the thirty-one not drained, eighteen were febrile for an average period of 1.5 days and thirteen were afebrile.

13. There were sixteen cases of thyroiditis for an incidence of 6.4 per cent.

14. As mentioned previously, since these cases were performed by the private attending men as well as members of the resident house staff, a complete long-range follow-up for further complications or recurrences was not possible.

COMMENTS

In order to avoid the confusion arising from the many different classifications of thyroid disease, the following classification, modeled from Anderson[1] and Warren and Meissner,[2] is used in which five main types are recognized:

I. Colloid goiter, also termed iodine deficiency, endemic or simple goiter
II. Diffuse toxic goiter (exophthalmic goiter, Graves's disease, Basedow's disease)
III. Adenomatous goiter
  A. With hyperthyroidism
  B. Without hyperthyroidism
IV. Degenerative and inflammatory goiter
  A. Amyloid goiter
  B. Granulomatous goiter (tuberculosis, syphilis, etc.)
  C. Chronic non-specific thyroiditis
    1. Hashimoto's struma (lymphadenoid goiter)
    2. Reidel's struma
    3. Mixture
V. Neoplastic goiter
  A. Benign (adenoma)
    1. Follicular
      a. Embryonal
      b. Fetal
      c. Simple
      d. Colloid
      e. Hürthle cell
    2. Papillary
    3. Unclassified
    4. Mixed
  B. Malignant (adenocarcinoma)
    1. Differentiated
      a. Follicular
      b. Papillary
    2. Undifferentiated
      a. Small cell
      b. Giant cell

According to Warren and Meissner,[2] most tumors of the thyroid are of epithelial origin with the ratio of adenoma to carcinoma being about 5:1. They stress the frequent difficulty in making a clinical distinction between a true tumor of the thyroid and the hyperplastic or hypertrophic nodule of an endemic goiter. Sometimes the distinction cannot be made even after the study of both the gross and microscopic material. Largely for this reason the clinical impression of tumors of the thyroid gland is higher than warranted.

Lahey,[3,4] in his review of thyroid operations on 22,000 patients performed up to 1943, showed an operative mortality of .88 per cent, while in a later series of 1,630 cases performed between 1943 and 1949, a .24 per cent mortality was reported. It is of interest that the antithyroid drugs came into use between these two series. In his last series with four deaths, there were two due to tracheal obstruction which was considered as preventable and two due to cardiac complications. In his series of 1,000 cases for hyperthyroidism, there was postoperative hemorrhage which required the wound to be reopened in 2.7 per cent of the cases. A tracheotomy was performed on 1.3 per cent of the cases and 4.5 per cent showed evidence of myxedema postoperatively. Varying degrees of tetany were shown in 1.5 per cent, with nerve injury in 1 per cent and a recurrence rate of 2.4 per cent. The incidence of thyroiditis was .75 per cent. In 1,971 patients with a preoperative diagnosis of a solitary adenoma, carcinoma was found in 10.04 per cent and those patients with multiple adenomas showed an incidence of .62 per cent.

Crotti[5] in his series of 11,662 operations on the thyroid, showed a total mortality of .3 per cent with the discovery of 192 cases of carcinoma for an incidence of 1.6 per cent. The incidence of thyroiditis was .88 per cent. There was laryngeal nerve injury in .18 per cent with parathyroid deficiency in .10 per cent, protracted in .025 per cent.

Newton[6] reports an operative mortality of .5 per cent in the last 1,000 operations for toxic goiter. Four hundred fifty of these patients were completely incapacitated before surgery. There was a recurrence rate of 1 per cent with myxedema of varying degrees in 2 per cent, controlled satisfactorily in all but .3 per cent.

Cole[7] in his series reports the incidence of carcinoma to be 7.2 per cent in 523 cases of nodular toxic goiter and 24 per cent in ninety-two cases of a solitary nodule.

Rawson[8] reports the finding of carcinoma in 19 per cent of all solitary nodules removed over a three-year period.

CONCLUSIONS

A review of 250 cases of thyroid surgery performed between the years of 1948 to 1953 has been presented. There were two postoperative deaths for an operative mortality of .8 per cent and postoperative complications occurred in forty-eight cases for an incidence of 19.2 per cent.

Many interesting features of what to expect with surgery of the thyroid can be noted from a careful review of the cases studied. Two are of particular note. (1) Prophylactic use of antibiotics postoperatively with no definite indications seemed to have little effect on the usual febrile course of two days' duration, which was seen in the majority of patients, whether on antibiotics or not. (2) Postoperative wound drainage lowered the incidence of hematoma requiring reopening of the incision for drainage, but increased the duration of the febrile course on an average of .7 days in the cases which were febrile and also increased the percentage of febrile cases.

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Operative Cholangiography

SURVEY OF PRESENT DAY OPINIONS

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IN 1953 Dr. George Crile, Jr. was asked his opinion of operative cholangiography during a panel discussion at the American College of Surgeons meeting in Boston. He replied,

TABLE I
USE OF OPERATIVE CHOLANGIOGRAPHY

Replies	Yes	No
Hospitals	102	34
Surgeons	78	39
Roentgenologists	28	19

TABLE II
TECHNIC OF OPERATIVE CHOLANGIOGRAPHY

	No.
Type:	
Immediate	37
Delayed	20
Both	29
Approach:	
Cystic duct	26
Common duct	35
Both	25
Contrast medium:	
Diodrast®	82 (35%)
	20 (70%)
Lipiodol®	4
Mulsopaque®	1
Technic:	
Initial dose	89
Fractionated doses	19

"Operative cholangiography is almost routine at the Cleveland Clinic; in a matter of minutes, we have the answer." However, Dr. Robert Zollinger did not agree with this opinion. In support of this notion, during the American Medical Association meeting in 1953, Drs. Waltman Walters, Frank Glenn and Russell Best expressed preferences for the more commonly used postoperative cholangiography.

These divergent opinions concerning the value of operative cholangiography are expressed by numerous equally competent general surgeons. In order to obtain a majority opinion informal questionnaires were forwarded to numerous qualified surgeons and roentgenologists, and answers were received from almost every state. A statistical analysis with subsequent dogmatic conclusions would obviously be fallacious. The responses were provocative, however, and their correlation tends to support the proponents of the technic.

TABLE III
ESTIMATE OF VALUE

Responses	Surgeons	Roentgenologists
Excellent	68	26
Good	4	6
Fair to useless	39	17

Tables I to III summarize these replies. As noted, the majority of the surgeons surveyed are employing operative cholangiography. Their enthusiasm varies, however, from that of the advocate to that of the skeptic. Table III, depicting estimate of value, contributes perspective.

As noted, the roentgenologists are less optimistic. Many stated bluntly that the time consumed was unwarranted. Others more tactfully replied that with improved equipment the results would be worth while. It is of interest that seven hospitals are either renovating older operating rooms or plan special operating rooms in proposed new hospitals.

The majority of responding surgeons and roentgenologists do not employ special equipment. Those who do use a special table or the grids are naturally more optimistic.

The comments supplementing the questionnaires add spice to the preceding brief analysis. Because of the large number of replies all those physicians cooperating cannot be acknowledged. However, those who replied can be

divided into three groups: (1) the advocates, (2) the conservatives and (3) the skeptics.

Advocates. Hicken provides one of the more enthusiastic endorsements. After performing more than 20,000 cholangiographic studies, "the majority at operation," he has earned the right to vouch for the usefulness of the procedure. Countering a frequent argument, he emphasizes that cholangiography does not lengthen but rather shortens the operating time. For only one example, he says, "It eliminates unnecessary explorations of the common duct." Paine likewise reports an increasing interest in operative cholangiography. In order to obviate retained stones he prefers completion cholangiograms through the T-tube. Hoerr believes that modern gall-bladder surgery is incomplete without operative cholangiograms. Tedrick believes its routine adoption in common duct surgery is obligatory, and Guiss has come to believe it is an indispensable part of the investigation of surgical problems of the bile ducts.

This general opinion was expressed by Best in 1936.[1] He stated that "Operative cholangiography is as essential to a surgeon doing gall bladder surgery as a gastrointestinal series is before considering a gastric resection." As previously implied, this early opinion of Best's has been modified. It is of interest, however, that many surgeons today agree with this original evaluation. This agreement can be deduced from the accompanying tables.

The roentgenologists surveyed include less ardent endorsers. Holt states that "With special facilities, operative cholangiography is definitely worth while. We very definitely endorse it. Plans for relocation of the surgical wing include equipment which will enable us to do operative cholangiography routinely."

Hodes reports, "For several years we have felt the need for operative cholangiography but not until now have we found ourselves in a position to use it. We are now equipping rooms with an overhead tube stand which will be energized by a 250 MA unit. Starting the first of the year we hope to use it routinely in all patients being operated upon for gall bladder disease."

Rigler notes that "Anesthetic difficulties can be corrected. Difficulties encountered with surgeons, such as casette placement and character of injection, are usually overcome with experience."

Conservatives. A few surgeons employ operative cholangiography only on rare occasions. Its value is sometimes dubious and many of these men lack the convictions of the preceding surgeons. With improved equipment, however, many of them confess that they could be converted to the group of advocates.

For example, Dunphy believes the procedure is "useful but not completely reliable. It is another valuable adjunct." Trimble believes that operative cholangiography is very important, but infers that present equipment is inadequate. In order to correct this, improved equipment is being placed in the new operating rooms at Johns Hopkins Hospital. As mentioned previously, other surgeons such as Harkins, Ravdin, Zintel and Fallis report that proposed new equipment in their hospitals will add to their interest in operative cholangiography.

Sosman adds a humorous supplement for the roentgenologists: "If we had better equipment in the operating room, we could do better work, therefore get more requests and make more mistakes."

Skeptics. Welch stated that he feels ". . . a little like somebody on the outside of a house looking in the window. I have felt the necessity to employ it so rarely that I have been amazed by the enthusiastic reports of others who have used operative cholangiography. We have recently set up an entirely separate unit for its investigation in the Massachusetts General Hospital. At the present moment, not much enthusiasm has been engendered except in the cases that are re-explored for recurrent or persistent common duct stones."

Simeone has not found the procedure valuable as a routine. "It should not be used to supplant clinical judgment in the residency training program." Allen is "sure that we are not aided very frequently," while Best states that operative cholangiography was discontinued in 1940 "because of our faith in the biliary flush. This seems to handle adequately those patients in whom jaundice has not been present and indications do not exist for opening the common duct. We are now considering a return to operative cholangiography but on a different plan, namely, taking a choledochogram only after placing the T-tube."

The skeptical roentgenologists are more dogmatic. For instance, Esposito concludes by stating, "1- The technical quality of the films

is poor. 2- The amount of time required to transport equipment is not feasible or justified. 3- The number of cases do not warrant the 'ideal,' i.e., special equipment held otherwise inactive in the operating room."

SUMMARY

Operative cholangiography is accepted by surgeons and roentgenologists with varying enthusiasm. In attempting to secure a majority opinion, informal questionnaires were sent to numerous qualified surgeons and roentgenologists.*

An analysis of these replies reveals that operative cholangiography is becoming more popular. The majority of those responding endorse the procedure. As experience increases and equipment is improved, the number of enthusiasts should increase.

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Meckel's Diverticulum

CLINICAL AND NECROPSY CASES

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THIS study is based upon all cases of Meckel's diverticulum admitted to the hospital from 1938 to 1954, together with a review of the postmortem examination of one death that occurred in the series. There was a second death for which there was no postmortem examination.

Meckel's diverticulum was first accurately described in 1808 by Johann Friedrich Meckel, the younger, a professor of anatomy, as a part of the ductus mesentericus which had not undergone the usual regressive process.

Meckel's diverticulum is the remains of the omphalomesenteric duct manifested by a blind sac or pouch arising about 18 inches proximal to the ileocecal valve. When present it is frequently attached to the navel by a fibrous cord structure which is the remnant of the primitive yolk stalk. The diverticulum usually has a diameter less than its ileal base and a length from ½ inch to 3 or 4 inches.

In our series there were thirty-five cases of Meckel's diverticulum found incidentally at 5,925 postmortem examinations from 1937 through 1947; an incidence of .006 per cent; other institutions report 2 per cent incidence.[1]

Meckel's diverticulum does not often create surgical problems; but when it does, the problem may be a grave one. "It is subject to: (1) inflammation (Meckel's diverticulitis), catarrh, ulceration, hemorrhage (60%), perforation or gangrene, similar to the appendix; (2) strangulation as in hernial sac, forming a type of Littre's hernia; (3) inversion into the ileum with intussusception; (4) twists or attachments, angulating or obstructing the intestine; (5) contained foreign bodies."[2]

This review emphasizes the need for early recognition of Meckel's diverticulitis and early exploration in suspicious abdominal conditions, although a definite diagnosis may not be made in advance. It is true that today great haste is not considered as vital as formerly, except possibly in cases of acute, uncontrollable hemorrhage. The immediate effects of acute Meckel's diverticulitis with possible intestinal obstruction may be well treated conservatively for a few hours until the distant consequences of electrolyte, water and protein loss can be partially or totally restored by replacement and decompression.

The treatment for inflammation of or obstruction due to Meckel's diverticulum is to remove the diverticulum, close the intestinal opening transversely and relieve any associated problem.

Statistics. Meckel's diverticulum occurs more often in males than females. In our series there were fourteen men and nine women. Of these, two men and one woman were Negroes. The youngest patient was eight months old, the oldest, fifty-one years of age.

The age group incidence was a follows:

8 mo. to 10 yr.	—5 cases
10 to 20 yr.	—7 cases
20 to 30 yr.	—5 cases
30 to 40 yr.	—5 cases
40 to 50 yr.	—0 cases
50 to 60 yr.	—1 case

Right lower quadrant pain was the most common symptom (49 per cent). This is in marked contrast to the experience of other clinics where intestinal hemorrhage (due to ulceration in Meckel's diverticulum) often was the most common symptom.[3] The pain often was very colicky (34 per cent). The associated symptoms in order of descending frequency were: (1) temperature (43 per cent), (2) vomiting (43 per cent), (3) periumbilical pain (twenty-one per cent), (4) nausea (21 per cent), (5) marked distention, x-ray evidence of small bowel obstruction (17 per cent), (6) diarrhea (12 per cent) and (7) bloody stool (4 per cent).

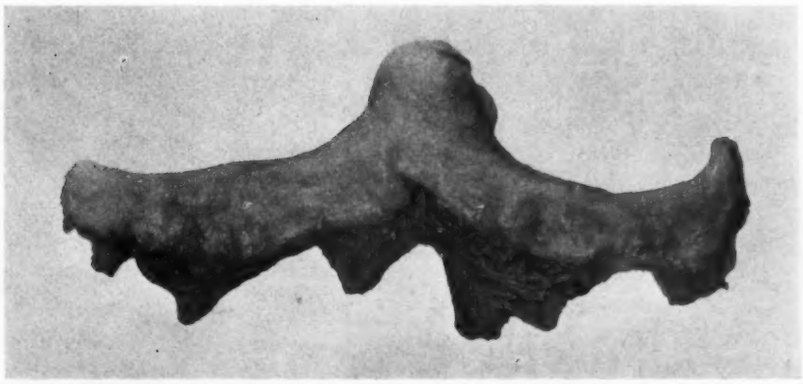

FIG. 1. Meckel's diverticulum in seventy-four year old man. Cause of death: adenocarcinoma of prostate, terminal bronchopneumonia, uremia.

It is noteworthy that seven patients gave a history of single or multiple attacks of severe abdominal pain ranging from fourteen years to two weeks before operation.

The pathologic disorders found were as follows: eleven cases of acute inflammation of Meckel's diverticulum, five cases of acute inflammation with perforation at base of Meckel's diverticulum, four cases of associated peritonitis, three cases of intestinal obstruction due to associated band and one case of local abscess.

Meckel's diverticulum was an incidental finding in a case of twisted left ovarian dermoid cyst, a case of acute suppurative appendicitis and a case of a large left ovarian cyst.

The preoperative diagnosis in these cases were as follows: fourteen cases of acute appendicitis, two cases of chronic appendicitis, one case of intussusception, one case of ruptured appendix with peritonitis, one case of ectopic pregnancy and one case of intestinal obstruction.

Three patients were operated on for possible acute appendicitis, although it was noted preoperatively that Meckel's diverticulitis was to be considered.

There was a pathologic report of the excised Meckel's diverticulum in eleven cases; five showing normal intestinal mucosa, two showing both gastric mucosa and pancreatic tissue and one gastric mucosa.

The following is a report of the two patients who died, with the final clinical diagnosis of ruptured Meckel's diverticulum with peritonitis.

Patient S. S. was an eight month old white baby boy who was admitted November 5, 1943, with a thirty-six-hour history of bloody stools and vomiting associated with irritability. The temperature was 101°F., with white blood count of 14,000, 70 per cent polys. X-ray showed air under diaphragm. Laparotomy revealed a perforated Meckel's diverticulum which was excised. Postoperatively the temperature rose rapidly to 105°F. and cyanosis and dyspnea appeared. The child died one day after operation.

Autopsy revealed a well closed ileal wound 22 inches proximal to the ileocecal valve, surrounded by a localized area of peritonitis. There was another small surface of peritonitis in the coils of intestine just beneath the operative wound. The remainder of the peritoneal cavity was uninvolved. Study of the excised diverticulum revealed areas of gastric mucosa and pancreas, and a minute perforation. A slight focal bronchopneumonia was present, especially in the form of mononuclear cell aggregations in the neighborhood of the bronchi. The lungs were moderately atelectatic and congested.

It is difficult to suppose that the limited degree of peritonitis seen postmortem was the sole factor in determining the outcome of this case. It is indeed possible that additional factors, such as electrolyte imbalance or circulatory collapse, may have played an important part.

Patient B. B., a twenty-three year old married Negro woman, was admitted on April 14, 1941, with a history of generalized lower abdominal pain of six days' duration, accompanied by nausea and vomiting the day of admission. She had experienced severe constipation for twenty-four hours before admission. Previous history was essentially negative except that two weeks before admission she had had an episode of cramp-like periumbilical

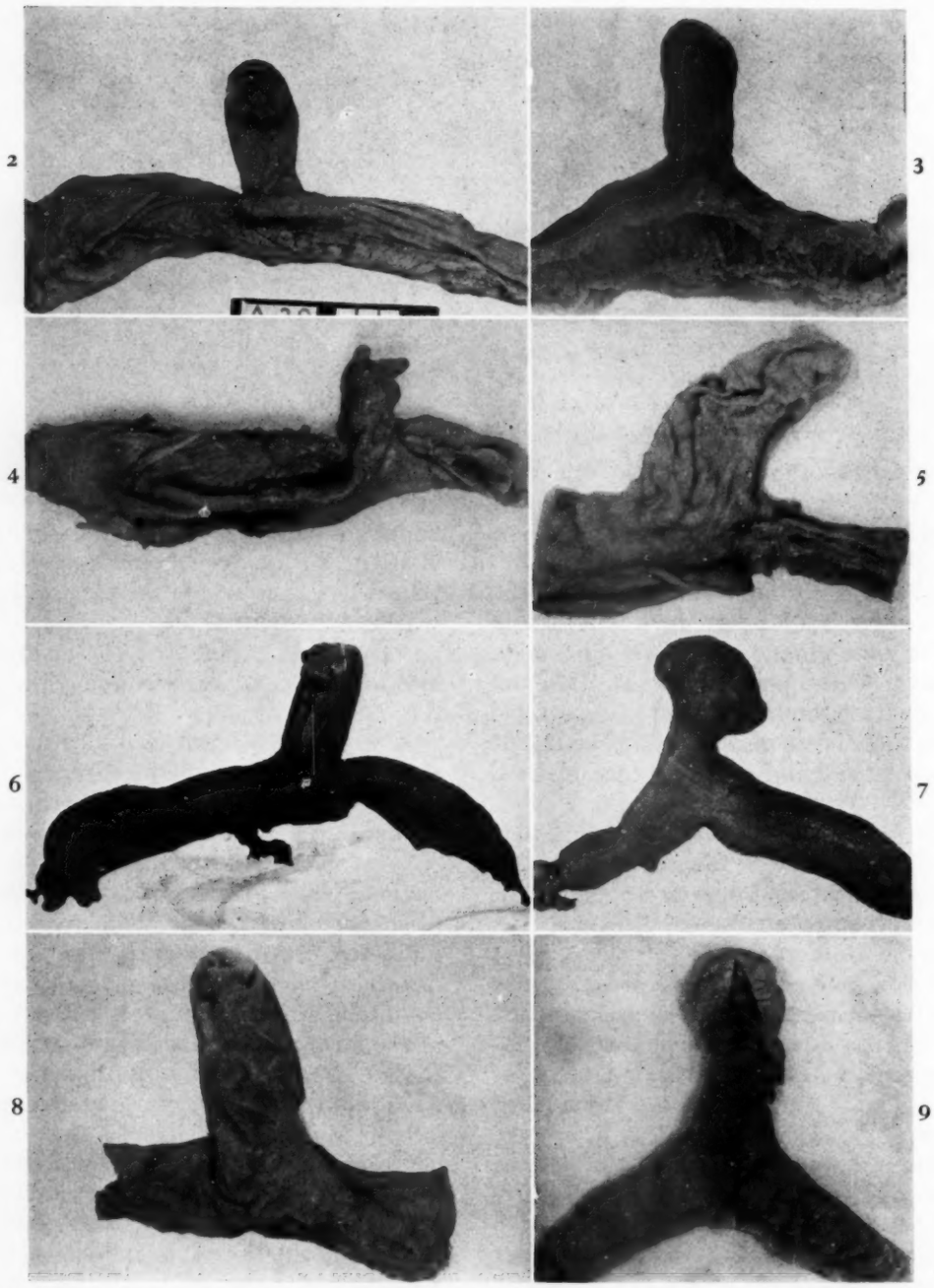

FIG. 2. Meckel's diverticulum in seventy year old man. Cause of death: carcinoma of eosphagus.

FIG. 3. Meckel's diverticulum in forty-six year old woman. Cause of death: anaplastic carcinoma of left breast with metastases.

FIG. 4. Meckel's diverticulum in fifty-eight year old man. Cause of death: cerebral hemorrhage.

FIG. 5. Meckel's diverticulum in seventy-two year old man. Cause of death: prostatic hypertrophy, uremia, lues.

FIG. 6. Meckel's diverticulum in sixty-three year old woman. Cause of death: luetic aortitis.

FIG. 7. Meckel's diverticulum in fifty-nine year old man. Cause of death: advanced pulmonary tuberculosis, coronary thrombosis.

FIG. 8. Meckel's diverticulum in sixty-three year old man. Cause of death: pneumonia, diabetes mellitus, renal insufficiency.

FIG. 9. Meckel's diverticulum in sixty-four year old man. Cause of death: pulmonary fibrosis, pneumonitis.

pain which gradually disappeared over a two-day period.

Physical examination showed marked abdominal distention with visible peristalsis. X-ray examination of the abdomen showed small bowel obstruction with many small bowel fluid levels.

The patient was operated upon on April 15th, after receiving replacement electrolyte therapy and decompression. A gangrenous Meckel's diverticulum with perforation and small bowel obstruction were found. Ileostomy was performed proximal to this area. The patient's course was gradually downhill and she died on April 29th, fifteen days after operative interference.

The discharge diagnosis was perforated Meckel's diverticulitis with peritonitis and intestinal obstruction. There was no postmortem examination.

Figures 1 to 9 illustrate Meckel's diverticulum found incidentally at autopsies. The legend explains the anatomic cause of death.

SUMMARY

A review is presented of twenty-three cases of Meckel's diverticulum, twenty requiring emergency surgery and three being incidental findings during the course of other operative procedures.

The findings of the postmortem examination of the one death in the series are recorded.

However low the present mortality is in Meckel's diverticulitis, it can be lowered still further by earlier laparotomy whenever the condition is suspected.

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Use of Aminoacridine in Infected Wounds

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The acridine compounds are closely related to the flavine dyes. Originally they were prepared synthetically and continue to be, although since their synthesis some natural acridine compounds have been found in coal tar. The first medical use of the acridine compounds took place during the first World War. They were used in the powder form in the treatment of infected wounds, but never achieved great popularity because of the local irritation produced and because of their high toxicity. In 1937 two new acridine compounds were synthesized by Albert and his colleagues.[1,2] These were 2-7 di-aminoacridine and 5-aminoacridine. (The latter is 9-aminoacridine in German literature.) Both were considerably less toxic than previous compounds, but 5-aminoacridine proved to be a more potent antiseptic.

Table 1

Culture Date	Organism	Acridine 1:5,000
February 23....	Moderate number Esch. coli	30 cc. q.2 h.
February 24....	Moderate number Esch. coli	30 cc. q.2 h.
February 27....	Moderate number Esch. coli	30 cc. q.2 h.
March 1.....	Occasional Esch. coli	30 cc. q.2 h.
March 3.....	Diphtheroids	.....
March 7.....	No growth in five days	.....

Most of the reports on the pharmacology and toxicology[3–6] of 5-aminoacridine indicate that systemic toxicity is manifested by nausea, vomiting, diarrhea and eventually liver damage. The lethal dose/50, worked out in mice and dogs, is in the range of 65 mg./kg.[6,10,11] Although the therapeutic and toxic doses are well separated, the inability to attain satisfactory blood or intraperitoneal levels[6] renders 5-aminoacridine unsatisfactory for parenteral use, even when introduced directly without approaching the toxic dose. On the other hand, when used locally, a dilute solution may be used, and bactericidal levels are reached with no local reaction[7] or systemic toxicity. 5-Aminoacridine is a weak base and is most active bacteriologically under slightly alkaline conditions. It is rendered partially inactive by its combination with certain proteins, including blood. Thus when used locally, either a buffer or a sufficient quantity of acridine should be used so that satisfactory physical conditions are met.

Our interest in the local use of 5-aminoacridine arose from the association of one of us (R. R. T.) with Dr. H. R. Hawthorne who started using the drug in 1945. Dr. H. Beaudet, working with Hawthorne, reported their use of 5-aminoacridine in seventy-five infected wounds[8] and stated they had no failures.

The following information is based on a total of seventy-nine cases treated with 5-aminoacridine since 1946. Our cases consisted of fifty-five infected surgical wounds, three infected traumatic wounds, four infected third degree burn wounds, fourteen infected areas resulting from vascular insufficiency and three other deep-seated infections. 5-Aminoacridine was used in dilute solution obtained by dissolving 1 gm. of 5-aminoacridine in 5 L. of half-strength physiologic saline.

Our method of treating these infected areas, after preliminary culture, was to use loosely applied gauze as packing or covering, and to apply acridine solution frequently either via a catheter incorporated in the dressing or directly to the dressing. The amount and frequency depended on the size of the area being treated and averaged 20 to 30 cc. every four hours. The dressings were changed daily or every other day, and subsequent cultures were taken from the gauze packings. The acridine was continued until all clinical evidence of infection disappeared. Several factors essential to rapid

improvement were soon evident. As would be expected, these factors pertained to good wound care and included cleanliness, débridement, adequate drainage and adequate drug contact so that no pockets remained untouched.

In all infected surgical wounds the results were very good. Clinically, the usual course was manifested by prompt loss of systemic toxicity. In four to five days the wound showed healthy granulations. These granulations were a deeper red than usual and seemed to bleed more easily than would be expected. About the sixth or eighth day we demonstrated marked decrease or disappearance of the pathogenic bacteria. (Table I.) In a few instances infected surgical wounds were deliberately not opened widely to test further the effectiveness of the antiseptic. Only two or three sutures at each end of the wound were removed to provide space for drainage and necessary manipulations. These wounds responded as well as those which were opened widely, and after eight to ten days of treatment, pressure applied over the undermined areas caused that portion of the wound to heal. Secondary closure was used in wounds that had been opened widely, but we always waited three to four days after the wound was granulating before closure was attempted.

The results of treatment of leg ulcers and infected stumps in cases with underlying vascular deficiencies were not completely satisfactory. In these cases it was possible to alter the flora, usually removing the pathogenic bacteria, but healing depended on correction of the underlying defect. If the vascular deficiency progressed, bacterial control would be lost. However, we believe that acridine enabled earlier surgical repair with less breakdown of the repair due to infection.

Our experience with burns was not sufficient to draw definite conclusions. However, three cases of infected third degree burns responded, as did other infected wounds, and skin grafting was successful. Since acridine can inhibit epithelial growth,[9] we thought it wise to use saline dressings for twenty-four hours preceding application of the graft. The fourth burn patient had a third degree 80 per cent body surface burn. He was nine years of age and was admitted one month after he had been burned, with large infected areas and no evidence of epithelialization. The patient died of malnutrition two weeks after admission. His death was preceded by high fever, stomatitis, vomiting and terminal convulsions. This case is the only one in which acridine might be accused of producing systemic toxicity from surface applications, since the L.D.-50 of 5-aminoacridine was inadvertently approached on several successive days.

TABLE II

Organism	Penicillin	Streptomycin	Chloromycetin	Aureomycin	Bacitracin	Acridine
Aerobacter	R*	R.	R.	R.	R.	1:12,000
Esch. coli	R.	S.	R.	R.	R.	1:48,000
Proteus	R.	R.	R.	R.	R.	1:3,000
Pseudomonas	R.	..	..	R.	..	1:6,000
Staph. aureus	S.†	S.	S.	S.	..	1:12,000
Pyocyaneus	R.	R.	R.	R.	R.	1:6,000
Str. hemolyticus	..	..	..	..	..	1:8,000

* R. = resistant.
† S. = susceptible.

A variety of microorganisms were found in this study. Most organisms found were those encountered in the large bowel. The most susceptible organism to 5-aminoacridine was Escherichia coli, as indicated in Table II. Also shown are the other organisms frequently seen and their *in vitro* susceptibilities to several antibiotics and to 5-aminoacridine. The pyocyaneus strain shown here was susceptible but in other cases there was overgrowth of pyocyaneus. Other organisms exhibited some decrease in susceptibility, but of no significant degree. Pyocyaneus was the only organism to demonstrate acquired resistance.

In conclusion, we believe 5-aminoacridine,

when used locally as described, is a valuable and safe addition to the local treatment of infected wounds, but believe that care must be exercised when treating large areas not to exceed one-fourth of the L.D.-50 in any twenty-four-hour period.

Acknowledgment: We wish to express our gratitude to the Bureau of Medicine, U.S.N., for making records available at the U. S. Naval Hospital, Philadelphia, and to the National Drug Company of Philadelphia, who kindly supplied the drug.

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The Open Treatment of Surgical Wounds

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FOR the past year or so we have made a concerted effort to dispense with the use of dressings or wound coverings of any kind on clean, dry surgical incisions. Our results with this approach to the problem of postoperative wound care have been most gratifying. The advantages of this point of view are so far reaching that we believe it important to review and report the reasons for adopting it and our experiences with it.

All whose surgical experience antedates World War II are aware of the fact that since this war profound changes in attitudes towards surgical problems have developed. Many of these changed attitudes are due to the development of antibiotics and appreciation of the importance of nutrition in the surgical patient, the availability and the more liberal use of blood transfusions, and in general, a better appreciation of the physiology and pathophysiology of the postoperative patient. Appreciating the changes that have taken place, one is constrained to be forever self critical to eliminate from surgical practice those procedures which are carried on for the sake of tradition rather than because of sound scientific knowledge.

Experience with dressings on face wounds has discovered them to be difficult to apply and maintain in position, uncomfortable for the patient and such a nuisance in general that they have long since been abandoned in our practice. Similarly, burns of the face, when treated with vaseline and pressure dressings, result in such an abomination of grease, oral and nasal secretions and spilled food, all held in place by the dressing, that these too have been abandoned. These concepts are no longer radical, and it is quite generally accepted as good practice to leave scalp and face wounds open and to treat burns of the face by the open method. Speculating on these experiences and noting the frequency with which trunk and extremity dressings become soiled, wet with perspiration, displaced and otherwise inefficient, the thought occurred that perhaps elimination of such dressings would be not only harmless, but beneficial.

The greatest obstacle to overcome in a change of this nature is the difficulty of the surgeon to adjust his thinking away from dressings on postoperative wounds. This is indeed a difficult concept to accept in the face of the tradition of centuries. Apparently there is a tendency on the part of the surgeon to minimize his personal resistance to the abandonment of dressings and project his resistance into the patient, by stating that the patient would not accept this procedure. It might be well at the very start of this report to emphasize the fact that patient acceptance of the open treatment of clean surgical wounds is phenomenal. As a matter of fact, when the patients are aware that their wounds are to be left open, they eagerly await the day or time when the dressings will be removed and the wounds exposed. The reasons for this will be elaborated later.

In order to establish a uniform procedure for this study the following rules were observed. All clean, dry surgical wounds were dressed in the operating room with a gauze strip moistened in alcohol and two or three gauze dressings fastened to the skin at their periphery with adhesive tape to permit ventilation of the wound beneath. (The alcohol dressing is used in the belief that it hastens coagulation of the blood along the skin edges.) When ward rounds are made on the first postoperative day, the wound is inspected; and if it is found to be dry, the dressing is removed and discarded. If capillary oozing is still present on the first day, the wound is again inspected on the second day and at this time the dressing is removed and discarded. In none of our cases was it necessary to keep the dressing on the wound for more than forty-eight hours.

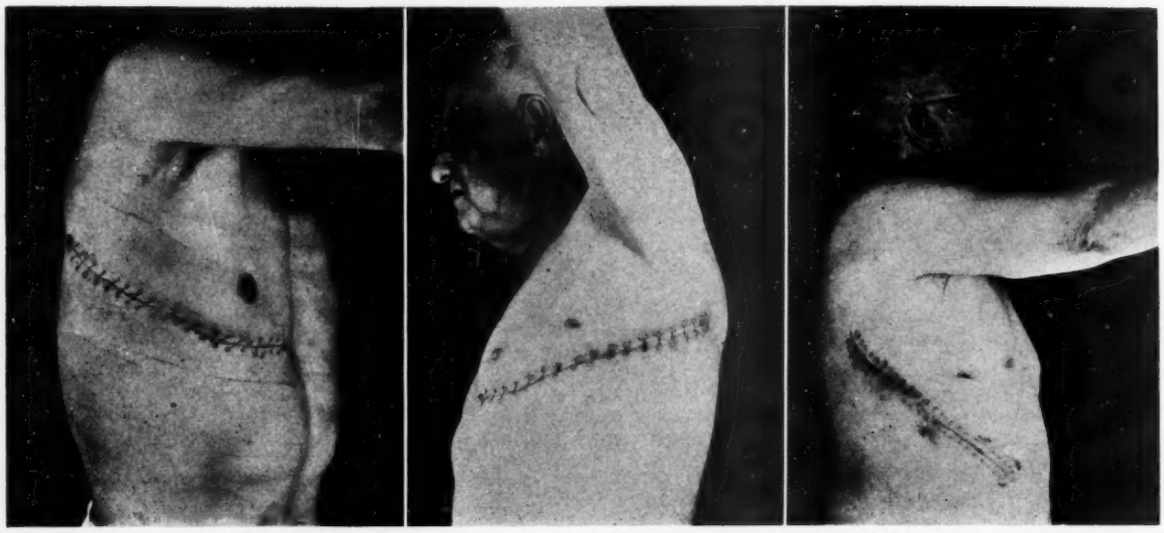

FIG. 1. Representative examples of the open treatment of thoracotomy wounds before and after removal of sutures. The open treatment of clean surgical wounds is especially significant in thoracotomy incisions by eliminating the adhesive tape binding.

Patient acceptance has been good. There is seldom so much as an inquiry about discarding the dressings. In only two instances in a year's practice has a patient requested a dressing, and then because of chafing of the incision by the pajama belt. The patients usually express relief at getting rid of the itching and constriction of the adhesive tape; and, of course, this regimen results in a marked reduction in adhesive tape reactions.

DISADVANTAGES OF DRESSINGS ON CLEAN SURGICAL WOUNDS

The most common disadvantage of a gauze dressing on a clean wound is that it becomes wet with perspiration. This results in maceration of skin edges, failure of a firm crust to form and increased capillarity of the skin sutures. In order to minimize these effects dressings must be changed frequently enough to keep them dry. Enforcement of such a technic results in an extreme drain on medical and nursing time, and if delegated to the Nursing Service alone, has the added disadvantage of concealing the wound from the physician. In climates where summer temperatures are high this is a rather important problem during the warm months of the year.

Another important disadvantage of surgical dressings on dry wounds is the restriction of respiratory movements which may result in diminution in pulmonary ventilation, laying the groundwork for atelectasis. This disadvantage is particularly pertinent in thoracic and upper abdominal incisions. Traction (incidental to respiration) on the adhesive tape used in dressings on such incisions may give as much pain and consequent voluntary splinting as the incision itself. (Figs. 1 and 2.)

As intimated previously, a covered wound is not accessible for ready inspection. It requires a change of dressing and consequent additional time, both medical and nursing, at rounds in order to accomplish this important aspect of postoperative care.

The frequent skin reactions to adhesive tape are an important disadvantage of surgical dressings. This aspect of the problem is seldom serious enough to make adhesive tape impossible to be used; however, it is important in its nuisance value. Vesication, folliculitis, itching and irritation are so frequently associated with the adhesive tape of surgical dressings that they are seldom even commented upon except by the patient. In addition, tape which is removed early may be removed painlessly in contrast to adhesive tape which has a week's growth of hair growing into it. This problem also seems to be important chiefly to the patient. (Figs. 3 and 4.)

Finally, the expense of the tape, gauze and disinfectant used, plus the expense of physician and nursing time not only in the actual performance of the dressing but also in the preparation of the materials, is a considerable disad-

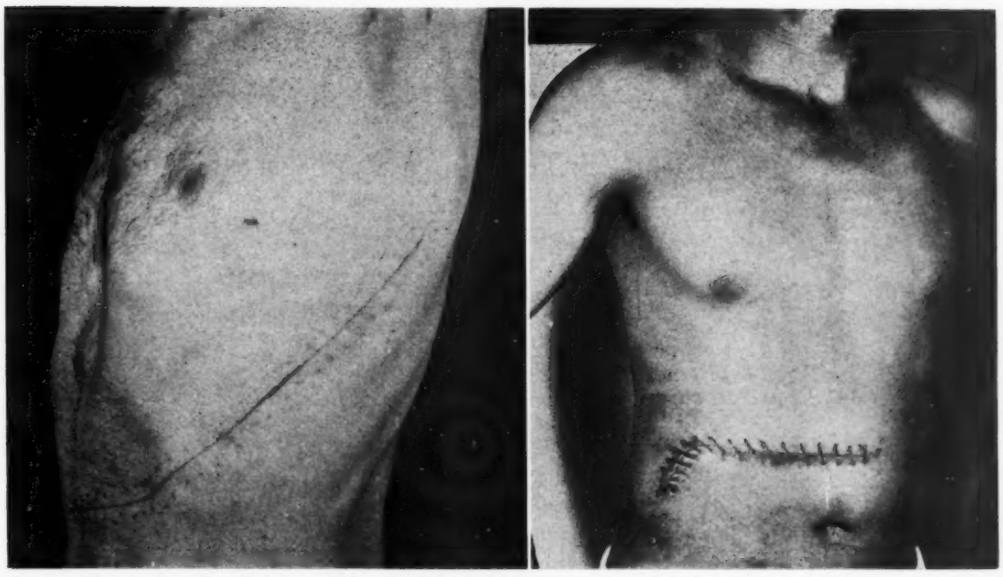

FIG. 2. Examples of a thoraco-abdominal and cholecystectomy incision treated without dressings. These incisions do as well as thoracotomies with the open treatment because of the absence of constricting dressings about the lower thorax.

FIG. 3. Examples of the open treatment of ventral and inguinal hernioplasty incisions. An inguinal hernia wound is much more comfortable without a dressing.

vantage. Estimates of the amount of money that might be saved on a nationwide basis by eliminating wound dressings are indeed staggering. The advantages of eliminating surgical dressings on wounds are, therefore, the converse of the disadvantages just outlined.

After establishing the rule of removing all dressings within forty-eight hours of the operation, the following instances were established as requiring a dressing. The ends of drains which discharge secretions are covered by a dressing which is changed frequently enough to keep it dry. When the drain ceases to function, it is removed and the dressings discontinued. Dressings are used for the secretions of wounds healing by secondary intention or granulation. In addition, dressings may be required in special instances when pressure is needed to obliterate a dead space or to control oozing. With the exception of these special instances all of the clean, dry wounds on our service are left exposed after twenty-four to forty-eight hours.

RESULTS

There was some question in our minds as to how to report these experiences. An attempt was made to classify the appearance of the

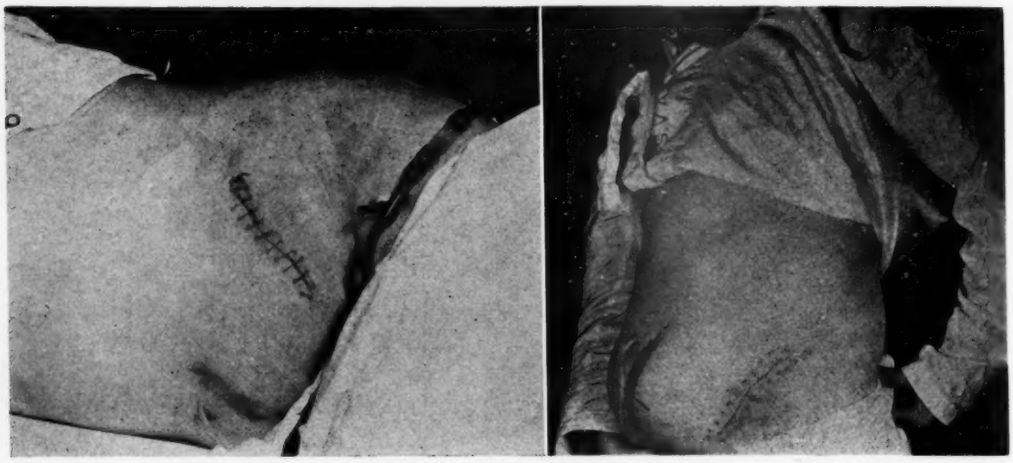

FIG. 4. Open treatment of the surgical incision following colostomy closure before and immediately after removal of sutures. Notice the minimal amount of reaction.

wound by the amount of erythema and reaction about the sutures or the wound edges. Sixty-two unselected cases were studied, and the statistics hardly seem weighty enough to tabulate. The most significant observation we can make as a result of our study is a reference to the old adage that "the proof of the pudding is in the eating." On the basis of sixty-two cases carefully studied for reaction, and on the basis of prolonged experience with over 1,000 clean surgical wounds treated without dressings, we can state confidently that the instance of wound complications is not increased and may, in fact, be decreased. The patient acceptance of this technic is good and there is little, if any, dissatisfaction voiced. The open treatment of clean surgical wounds is believed to be a real advantage in the postoperative care of surgical cases by reducing morbidity, labor time and material costs.

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Adenoacanthoma of the Cecum

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THIS report is being made for three reasons. First, there are very few reports of adenoacanthoma of the cecum and it is believed that this case should be added to the literature. Second, in the case reported, a frozen section biopsy at time of surgery was reported as showing a squamous cell carcinoma. As the surgeon could not explain such a tumor in the cecum, he was concerned about its origin. Knowledge of the possible occurrence of such tumors in the cecum, therefore, becomes significant. Third, there has been considerable discussion in the literature concerning the origin of heterologous mixed squamous cell adenocarcinoma (adenoacanthoma). It is believed that this case adds evidence to the belief that metaplasia following long-continued irritation may be responsible for some cases of adenoacanthoma.

The occurrence of carcinomas exhibiting both adenomatous and squamous elements within the same tumor has been noted for many years. Herxheimer,[3] as early as 1907, referred to the presence of such tumors in the stomach, pancreas, cecum and uterus. He classified such tumors as "adenokankroid" and this term is still used occasionally although the most commonly used designation is "adenoacanthoma." These tumors have been described in the ovary,[5,8,10] uterus,[1,2,9] thyroid,[13] sweat glands, stomach,[7,16,18] esophagus[14] and in the colon.[12] It is not difficult to visualize the development of such tumors in regions in which the mucosal lining changes normally from squamous to columnar glandular type. This occurs in such organs as the uterus, esophagus and rectum. It is also conceivable that adenoacanthomas would develop in organs in which squamous metaplasia may be seen, such as the lung, pancreas, prostate or thyroid. However, the development of such mixed adenosquamous carcinomas in areas which do not fall into either of the foregoing categories is much less frequent and it is more difficult to explain the histogenesis in such cases. In our pathology department we have seen cases of adenoacanthoma occurring in areas in which there is normal continuity of the squamous and glandular epithelium or in which metaplasia is prone to occur, but until recently we had never seen such a tumor in which these conditions did not exist, specifically in the cecum.

A review of more recent literature shows that adenoacanthoma of the cecum has occurred and been reported although the number of cases is exceedingly small considering the relative frequency of carcinoma of the cecum. Herxheimer[3] listed one such case in which the tumor was mainly a colloid adenocarcinoma throughout in which areas of poorly staining flat cells could be seen in which both keratin and intercellular bridges were present. No history was included in this case report.

Humiston and Piette[4] report an unusual case in a white man, thirty-one years of age, who had had recurring attacks of abdominal pain for two years. At surgery, a markedly inflamed appendix was removed. It was adherent by its distal extremity to what appeared to be a tumor encysted in the outer wall of the cecum. The tumor was enucleated without difficulty and formed a cystic structure which did not communicate with the lumen of the bowel. Because the contents of the cyst were largely cholesterol and because of the squamous epithelial lining, the authors designated their case as "true cholesteatoma of the cecum." It is questionable whether this case should be included as an adenoacanthoma of the cecum although it is listed as such in several references.

Plenge[11] reported a case of adenocancroid of the cecum in a twenty-eight year old woman. His case, similar to ours, was associated with occurrence of a fistulous tract prior to the development of the adenoacanthoma.

These three cases are the only ones which

specifically involved the cecum. Rabson's[12] case was not actually in the cecum but located 5 cm. from the ileocecal valve.

CASE REPORT

The patient, a fifty-five year old white merchant seaman, entered Long Beach V. A. Hospital on August 24, 1953. His chief complaints were episodes of crampy lower abdominal pain for four months, and a mass in the right lower quadrant of the abdomen for one week.

About ten and a half years previously, in February, 1943, the patient had had an anterior resection of the sigmoid colon for "cancer of the bowel." The continuity of the bowel was restored by an end-to-end anastomosis. Tube cecostomy was also performed at that time. After two weeks the tube was removed but a fecal fistula persisted. After four months, surgical closure of the cecostomy was necessary to eliminate the fistula. Since 1943, and until the present illness, the patient had enjoyed very good health.

About four months prior to entry episodes of lower abdominal crampy pain began. At first the episodes were mild and infrequent, and completely relieved by tincture of belladonna. As time went by, the episodes became more severe and frequent. During an episode, one week prior to entry, the patient noted a lump in his abdomen beneath the scar of the wound for closure of the cecostomy.

No weight loss, weakness, diarrhea, constipation, anorexia, nausea or vomiting had occurred during this illness. The past history was not remarkable, except for surgery in 1943. The systemic review was also not remarkable.

Physical examination revealed a well nourished, alert white man of fifty-five, who did not appear ill. The temperature was 98.6°F.; pulse, 80; blood pressure, 140/80.

Positive physical findings were confined to the abdomen. In the left lower quadrant there was a well healed surgical scar, running obliquely from the suprapubic area to just above the anterior superior spine. In the right lower quadrant a well healed oblique surgical scar was noted just above and medial to the anterior superior spine. Beneath this oblique scar a firm, rounded, 5 cm. mass was present which was somewhat movable but appeared to be attached to the anterior abdominal wall. The liver was not palpable. Digital rectal examination was negative.

Laboratory examination revealed a hemoglobin level of 15.6 gm, and a hematocrit of 50. The white blood cell count was 9,400. The differential count was polymorphonuclear cells, 55 per cent; lymphocytes, 38 per cent; monocytes, 6 per cent and eosinophils, 1 per cent. Urinalysis was normal. Six stool examinations were negative for ova and parasites. Only one of these stools showed occult blood. The serologic test for syphilis was negative.

X-ray of the chest was within normal limits. A barium enema on August 28th showed a constant defect adjacent to the ileocecal valve. There was reflux of barium into the appendix and ileum, both of which appeared to be normal. No colonic polyps were noted. The site of the previous anastomosis in the sigmoid colon was indicated by a small degree of narrowing. Cholecystogram on August 31st showed a normally functioning gallbladder. On September 8th upper gastrointestinal series and small bowel study were found to be normal.

On sigmoidoscopy, eight polyps were seen in the last 20 cm. of the rectum and colon. One polyp had a long narrow pedicle and measured 1 cm. in diameter; the remainder were 4–5 mm. in diameter.

After bowel preparation with sulfathalidine and neomycin, an exploratory laparotomy was carried out on September 10th. The anterior and lateral part of the cecum was situated in a defect of the abdominal wall. The serosa of the cecum was adjacent to the under surface of the external oblique aponeurosis. A mass was present in this area, the nature of which could not be determined from external examination. The liver was free of metastases. The nodes along the ileocolic artery could not be palpated because of fat in the mesentery. The cecum was cored out of the abdominal wall with a margin of normal muscle. Cecotomy showed a 3 by 5 cm. ulcer located on the posterior wall of the cecum. This had a raised indurated margin, encroached to some degree on the ileocecal valve, and extended laterally into the portion of the cecum which had been situated in the abdominal wall. On the basis of a frozen section showing squamous cell carcinoma, right hemicolectomy and end-to-end ileotransverse colostomy were performed.

The postoperative course was uneventful. On the fourth postoperative day the Miller-Abbott tube was removed. The diet was gradually increased from a full liquid to a

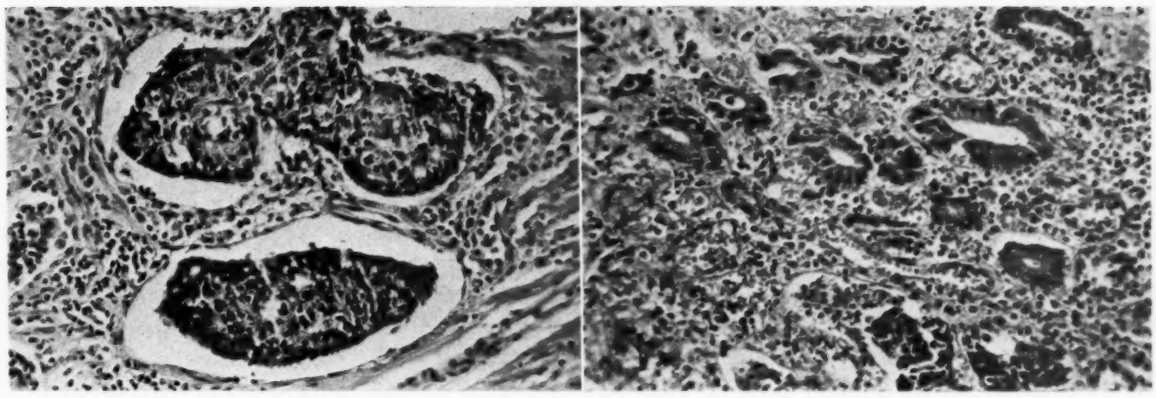

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FIG. 1. Intravascular portions of tumor forming sheets of squamous-like cells. Intercellular bridges were infrequent. Both intravascular and extravascular spread showed similar squamous features.

FIG. 2. Intramural portion of tumor showing atypical gland formation.

regular diet. On the fourteenth postoperative day the patient was placed on leave from the hospital. On October 16th he returned from leave and the polyps of the rectum were removed through the sigmoidoscope. On October 22nd block excision of the abdominal wall at the site of the cecostomy was performed, and the defect was repaired with the aid of stainless steel mesh. The patient was discharged to outpatient follow up by the Tumor Board on November 3rd. Pathologic examination of this latest surgical specimen failed to show any evidence of neoplasm.

Pathologic report was as follows: Gross specimen consisted of a large segment of ascending colon, the cecum and appendix and approximately 35 cm. of terminal ileum. The colon measured about 20 cm. in length and the appendix 9 cm. in length. The lumen of the colon was patent to the ileocecal valve and measured 4 cm. in diameter.

In the cecum a spherical mass was seen projecting laterally from the wall of the cecum just distal to the ileocecal valve. This mass measured approximately 4.5 cm. in diameter and most of the growth was extrinsic to the mucosa so that only slight encroachment upon the lumen of the cecum was present. However, on cut section the mass was found to consist of a large irregular ulcerating lesion which undermined the ileocecal valve and extended partly into the valve. As a result of the ulceration a diverticulum was formed in this area. The floor of the ulcer was covered with necrotic yellowish debris. The wall of the cecum in this area was thickened and edematous, measuring up to 1 cm. in thickness. The outer surface of the diverticulum was congested and covered by irregular collections of fibro-fatty tissue. The ileocecal valve was very edematous and this edema plus the ulceration probably accounted for the obstruction at the ileocecal valve. On cut section through the ulcerated area, the wall was firm, the cut surfaces were smooth and yellowish white and the lesion extended through the wall to the serosa. Just external to the serosa, in this area, were several firm gray-white lymph nodes. Grossly, the ulcer, resulting diverticulum and lymph nodes all appeared to be malignant. The appendix, remainder of the colon and segment of ileum showed no gross abnormality. No further enlarged or suspicious lymph nodes were found.

Microscopic sections through the ulcer floor described grossly showed that the floor was covered by a dense pinkly staining hyaline-like material which extended for several millimeters into the deeper tissue. Extending up to this layer of hyalinized material were neoplastic cells which were arranged in small nests and larger groups and extended via the lymphatic channels, through the entire thickness of the wall of the cecum. The neoplastic cells had assumed two different patterns. In many areas, the cells were arranged in sheaths of squamous-like cells which were polyhedral to round in shape and had round nuclei with prominent nucleoli. (Fig. 1.) For the most part no evidence of intercellular bridges was noted, but occasionally such structures were seen among the squamous cells. In other portions of the tumor, atypical glandular spaces were formed, lined by cuboidal epithelium. (Fig. 2.) Peripherally, a number of the glands showed a transi-

tion from the cuboidal epithelium to a modified squamous type of epithelium. As a result of this, areas of glandular tissue were adjacent to areas of squamous tissue. The transition from the cuboidal epithelium lining the glandular spaces to the squamous type of epithelium would seem to indicate that the process was one of metaplasia. Sections through one of the lymph nodes, showing metastases of the tumor, revealed again the dual appearance of the neoplasm. In some areas, again, the neoplasm had the appearance of a squamous cell carcinoma and in other areas, atypical glands were formed. The diagnosis on the surgical specimen was adenosquamous cell carcinoma of cecum with metastasis to lymph nodes.

COMMENTS

Three views concerning the origin of heterologous mixed squamous cell adenocarcinoma have been advanced. These are: (1) that these tumors result from true metaplasia; (2) that they arise from heterologous embryonic rests; (3) that they arise from direct stimulation of undifferentiated basal cells.

A considerable number of pathologists reporting cases of adenoacanthoma favor their origin from areas of metaplasia in normal mucosal cells. It is well known that long-standing irritation which changes the normal physiologic activity and function of cells may lead to metaplasia. This is well illustrated in the metaplasia which occurs in bronchiectatic cavities in which the bronchial mucosa is exposed to chronic irritation and no longer plays its normal part in respiration. Perhaps as Wells[17] has stated when the irritation continues until cancer results, the newly acquired property of forming squamous cells becomes fixed, resulting in a squamous cell carcinoma. The authors found this to be true in a recently reported case of carcinoma arising in a bronchiectatic cavity.[19]

On the other hand, Wood[18] favors the view that such mixed adenosquamous carcinomas result from direct stimulation of undifferentiated "basal cells." He refers to the work of Stewart[15] who injected methylcholanthrene with serum as a vehicle into forty-seven C_3H mice, and obtained the following stomach tumors: adenoma in seven, adenocarcinoma in six, adenoacanthoma in six, adenocarcinoma and sarcoma mixed in twelve, adenoacanthoma and sarcoma mixed in two, sarcoma in three, squamous papilloma in nine and squamous carcinoma in two. Wood believed that it was significant that in these mice the lesions were carcinomatous from the beginning and showed no evidence of antecedent or concurrent squamous cell metaplasia. The squamous cell component developed seemingly *de novo*. Because of these findings, Wood believed that antecedent squamous cell metaplasia was not a necessity for development of adenoacanthoma and that these tumors arose from undifferentiated "basal" cells.

The presence of displaced ectodermal rests may be the explanation for the occurrence of adenoacanthoma in such regions as the rectum, uterus or upper cardiac portion of the stomach. However, such rests cannot be readily explained in the cecum.

In our case it is significant that the patient had had a fistula in the region of the cecum prior to the development of the adenoacanthoma. This fistula, however, had been present some ten years prior to the development of the neoplasm. A similar finding was reported in Plenge's[11] case. Also Humiston and Piette's[4] case was associated with a previous acute appendicitis. It is conceivable that in all three cases the presence of the inflammatory process may have resulted in metaplasia and eventually in adenoacanthoma. However, it is possible that some cases of adenoacanthoma arise from undifferentiated basal cells while others arise from metaplasia or from embryonic rests in which such a possibility exists.

SUMMARY

A case of adenoacanthoma of the cecum is presented. Such cases are rare. The possibility that this case was related to the presence of a cecal fistula following cecostomy is suggested. A similar case is presented by Plenge. These cases may, perhaps, be considered as following metaplasia associated with long-standing chronic inflammation. In other cases, however, the neoplasm may arise from undifferentiated "basal" cells or from misplaced embryonic rests.

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Te linde et al. believe that "atypical hyperplasia," "proliferative hyperplasia," "adenomatous hyperplasia," or glandular cystic hyperplasia may accompany endometrial cancers or occasionally be precursors of them. These patients, therefore, should be carefully followed for possible onset of a frank endometrial malignancy three or more years later. (*Richard A. Leonardo, M.D.*)

Leiomyoma of the Duodenum

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BENIGN and malignant tumors of the small intestine are uncommon lesions. In 1932 Raiford[1] reported a large series of tumors of the gastrointestinal tract in which there were fifty benign and thirty-eight malignant lesions arising in the small intestine. These fifty benign tumors constituted about 24 per cent of the entire benign group, while the thirty-eight malignant tumors made up only 5 per cent of the malignant group. Leiomyoma is the most common benign lesion of the small intestine, and about 80 per cent of these occur in the jejunum and ileum and the remaining 20 per cent in the duodenum.[2] If one considers only the duodenum, adenomas are slightly more common than leiomyomas.[3]

In 1952 Straus and O'Kane[4] collected fifteen cases of leiomyoma of the duodenum and added a case of their own. To this total one can add nine cases reported by Olsen et al.,[5] two by Oberhelman et al.,[6] and two by Ebert et al.[7] We wish to report two other cases because of their rarity and some unusual features.

CASE REPORTS

CASE 1. L. N., a twenty-five year old white male construction worker, was admitted for the first time January 8, 1953, with the complaints of tarry stools, weakness and dizziness. He had been in excellent health until one week before admission when a cold with non-productive cough developed, followed three days later by tarry stools. These continued at the rate of four a day for four days. Two days before admission he vomited undigested food containing clots of dark blood. No history of abdominal pain, discomfort or jaundice was obtained. He was a moderate drinker of alcoholic beverages, consuming one or two pints of whiskey each week.

On physical examination blood pressure was 130/58, temperature 101°F., pulse 130 and respiration 20. The patient was a well developed, well nourished, pale white male who appeared acutely ill. Inspiratory wheezes and scattered rhonchi were present in the lungs bilaterally. The liver was palpable one finger-breadth below the right costal margin and was tender. The spleen was not palpable.

The laboratory reports can be noted in Table 1.

Bedside chest x-ray on admission was essentially normal. On January 21st x-ray study of the upper gastrointestinal tract showed an indentation of the left lateral margin of the stomach due to an enlarged spleen. Esophagram and small intestinal films were within normal limits. On fluoroscopy ten days later there was some difficulty in filling the duodenal bulb with rapid transit of the barium through this region. A small intestinal series of films was again normal.

The patient was immediately given whole blood transfusions and received 9,500 cc. the first eight days, 4,000 cc. of which was given in the first three days. During this period his red blood count rose to 3,800,000 and his hemoglobin to 10.4 gm. per 100 cc. The hematocrit reached 45 per cent. He was placed on a bleeding ulcer diet, banthine®, ascorbic acid, calcium carbonate and procaine penicillin. After twelve days his stools became brown in color and guaiac-negative. Esophagoscopy was negative. Caffeine gastric analysis was reported 18 mEq. free Hcl in the half-hour specimen and 20 mEq. in the two-hour specimens. All liver function tests were normal.

He was discharged on an ulcer regimen to return in two months for further observation and study.

The patient remained well after discharge, but lost 20 pounds in weight. One week before his second admission, April 28, 1953, sharp mid-epigastric cramping and a desire to defecate developed after eating chili. He became nauseated and vomited, but the vomitus contained no blood. His stools for the

next three days were hard and black. He began to have recurrent mid-epigastric pains on an empty stomach, relieved by milk. The pain frequently wakened him at night. Two days before admission the patient began to notice some change in skin color.

perature came down to 99°F. He then remained afebrile. He had received 3,500 cc. whole blood during this two-week period and showed no signs of bleeding after the seventh hospital day.

The patient was definitely jaundiced at the

TABLE I

SUMMARY OF LABORATORY DATA, CASE I

	HEMATOLOGY										BLOOD CHEMISTRY																				
DATE	RBC	HEMOGLOBIN IN Gms.	WBC	NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	HEMATOCRIT %	SED. RATE (CORR.)	CEPHALIN FLOCCULATION	THYMOL TURBIDITY UNITS	BRONSULFALEIN	ALKALINE PHOSPHATASE BODANSKY UNITS	SERUM BILIRUBIN mg./100 ml.	CHOLESTEROL mg./100 ml.	PROTHROMBIN TIME %	TOTAL PROTEIN Gms./100 ml.	ALBUMIN	GLOBULIN Gms./100 ml.	NPN mg./100 ml.	CALCIUM mEq.	FASTING BLOOD SUGAR mg./100 ml.	SERUM AMYLASE mg./100 ml.	SERUM SODIUM mEq.	SERUM POTASSIUM mEq.	SERUM CHLORIDE mEq.					
1st ADMISSION																															
1-8	1.82	7	7,450	67	33			16		Neg	Neg	0	.85	.54		48%					4.1		100								
2-18	4.33	12.2	8,100	75	21	2	2	38	30	∓	1.5	25%	3.65	.6	210	100%	7.3	4.8	2.5	3.4											
2nd ADMISSION																															
4-28	2.85	9.7	8,600	78	20	1	1	25	20	2+	1.1	8%	2.2	.6		100%	5.7	3.1	2.6	34		51	109								
5-11										2+	3.2		3.8	1.27	238																
5-23	4.45	13.	4,800	74	20	4	2	39	23		2.4	4%	3.8	.7	197	100%	7.1	3.4	3.7												
6-11										2+	1.4		4.35	.6		100%	7.1	4.8	2.3	35				130	5.0	78					
7-3	4.42	13.2	7,100	71	27	2	0																								
7-4	4.47	13.7	16,650	73	13	14										51%	6.7	4.1	2.6						10.0	88.4					

On physical examination blood pressure was 105/70, temperature 100.8°F., pulse 120 and respiration 18. The patient appeared acutely and chronically ill, and there was a sallow color to the skin. There were many "cafe au lait" spots over the back and extremities. There were two small, freely movable, firm nodules, each 0.3 cm. in diameter, just under the skin, one in the left flank and the other over the right anterior chest. No definite jaundice was present. The liver was barely palpable and smooth. The spleen was enlarged three fingerbreadths below the left costal margin in the mid-clavicular line. There was tenderness to palpation in the right upper quadrant just to the right of the umbilicus. Black stool was present in the rectum.

The laboratory data are tabulated in Table I.

During the first two weeks in the hospital the patient's fever spiked to 101°F. each day, and became progressively more toxic. Multiple blood cultures and enteric and heterophil agglutinations were negative. Penicillin and aureomycin were started after twelve days, and gradually over a six-day period the temperature came down to 99°F. He then remained afebrile. He had received 3,500 cc. whole blood during this two-week period and showed no signs of bleeding after the seventh hospital day.

The patient was definitely jaundiced at the height of his fever on May 7, 1953, his tenth hospital day. Urine specimen was 4 plus for bile on the Harrison spot test. This cleared within two days. Following this his appetite increased, he became stronger, gained weight and became ambulatory. He no longer showed any signs of progressive disease, and his stools were negative for occult blood. Biopsy of one of the skin masses was reported as neurofibroma.

Upper gastrointestinal roentgenograms and chest x-ray were normal, as were cholecystogram and intravenous pyelogram films.

On July 3, 1953, with the patient under endotracheal cyclopropane and curare anesthesia, an exploratory laparotomy was performed. A firm, rubbery tumor mass in the wall of the second part of the duodenum was found. This was encroaching upon the head of the pancreas and displaced the common duct. An attempt was made to remove the tumor by local excision, but this was not possible. A pancreatico-duodenectomy was required for removal of the tumor. Splenic enlargement was noted. During the operation there was generalized oozing of blood throughout the operative

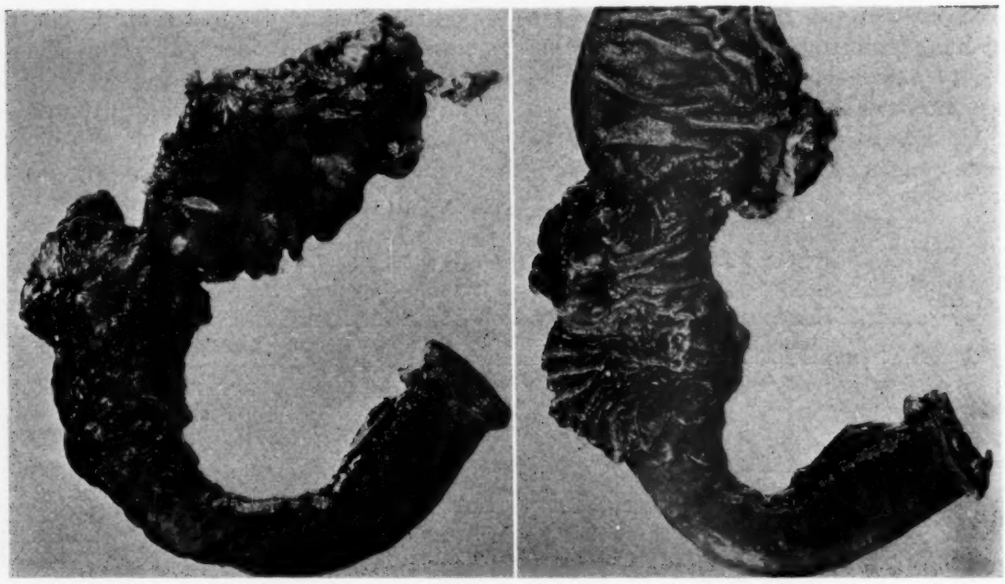

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FIG. 1. Case 1. Anterior surface stomach, duodenum and upper jejunum showing lobulated tumor projecting from wall of duodenum.

FIG. 2. Case 1. Duodenum opened, showing sinus tract leading into lumen from central part of tumor.

field. The patient withstood the procedure well and received 1,500 cc. of whole blood during the four and a half hour operation.

Upon his return to the ward the blood pressure was 128/90 and pulse 130. He remained thus stabilized for three hours, when his blood pressure dropped to 102/80 and the pulse became 144. Although he was given 9,500 cc. of whole blood and 9,000 cc. of intravenous fluids with neo-synephrine® and norepinephrine added, he dropped into irreversible shock. In addition, he received adrenal cortex extract, aqueous cortisone, desoxycorticosterone and lipo-adrenal extract without favorable response. He died twenty-seven hours after surgery.

The gross specimen consisted of the distal portion of the stomach, the duodenum and the proximal portion of the jejunum. (Fig. 1.) Attached to the second portion of the duodenum was a firm mass 4 by 6 by 5 cm. with the head of the pancreas lying directly posterior. On section the tumor was a homogeneous mass of coarse lobulated tissue having central hemorrhage and necrosis. There was a sinus tract leading into the duodenum. (Fig. 2.) The central portion of the tumor lay 3.0 cm. above the ampulla of Vater and the inferior border was directly adjacent to the common duct, displacing it and partly surrounding it near the ampulla of Vater. The duct of Santorini was completely surrounded by the tumor. Most of the tumor lay outside the duodenal muscular wall, but small lobulations extended into the submucosa, especially near the entrance of the common duct and duct of Santorini.

Microscopically the tumor was composed of moderate-sized, uniform, spindle-shaped cells with abundant eosinophilic cytoplasm and ovoid to round nuclei. No mitoses were seen. There was much necrosis and hemorrhage in the central part. The tissue was very vascular with whorling and interlacing of the fibers. (Fig. 3.) The tumor did not invade the pancreatic parenchyma. A Masson trichrome stain showed the tumor to be of muscle origin.

When the peritoneal cavity was opened at autopsy, it contained 4,000 cc. of clotted and liquid blood. Dissection of the region of the duodenum disclosed no large open vessels, but extravasation of blood throughout the tissues was marked.

The spleen weighed 490 gm. and was very soft; the cut surface showed marked diffluence. The liver weighed 1600 gm. and was pale brown in color. The choledochojejunal anastomosis was patent and intact, as was the gastrojejunostomy. The remaining distal part of the pancreas weighed 60 gm. and measured 15 cm. in length. The anastomosis between the pancreatic duct and the bowel was intact.

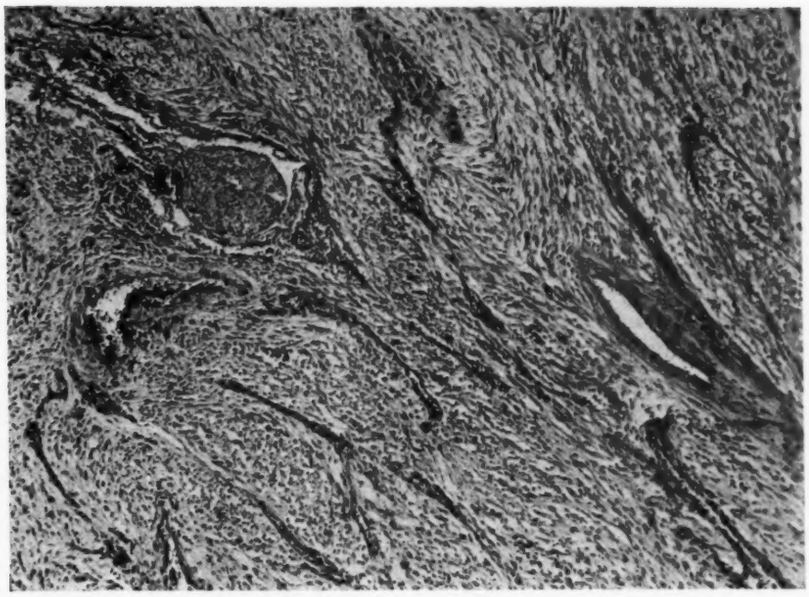

FIG. 3. Case 1. Photomicrograph showing interlacing bundles of smooth muscle fibers.

Microscopic examination of the organs disclosed widespread infarction and necrosis throughout the liver, pancreas, spleen and kidneys, interpreted as a result of prolonged shock.

CASE II. A. W., a fifty-two year old pipefitter, was first seen December 8, 1949, with the chief complaint of sudden onset of upper abdominal pain, nausea and vomiting of two days' duration. He gave a history of four similar attacks during the past year, each lasting from two to three days. There was no history of jaundice or hematemesis, but he had noted frequent tarry stools both during and between these attacks.

On physical examination blood pressure was 150/64, temperature 100.2°F., pulse 104, respiration 20. The patient was a well developed, well nourished white man who was extremely pale and appeared chronically ill. The abdomen was slightly distended, and there was tenderness to pressure in the epigastrium and in the left lower quadrant. Tarry stool was present in the rectum.

Laboratory reports revealed that on admission the red blood count was 1,850,000, with a hemoglobin of 5.6 gm. The white blood count was 11,650 with 65 per cent neutrophils and 35 per cent lymphocytes. The total proteins were 4.4 gm. with 2.9 gm. of albumin and 1.5 gm. of globulin. Non-protein nitrogen was 39 mg. Liver function tests were all within normal limits. Stool examination showed strongly positive guaiac.

On December 12th x-ray study of the upper gastrointestinal tract revealed narrowing of the duodenum just beyond the bulb with a 2.5 cm. rounded defect at the beginning of the descending portion of the duodenum. Below this at the junction of the second and third portions of the duodenum, on the medial contour, a 1.0 cm. projection with a narrow mouth was noted. Roentgenologic impression was that the filling defect represented a tumor and the projection was either a dilated ampulla of Vater or a diverticulum.

The patient was placed on a bleeding Meulengracht diet, bedrest, atropine and given whole blood transfusions. He vomited dark clotted blood and passed both liquid, dark, bloody stools and formed, tarry stools. He received 6,500 cc. of whole blood during the first three days, and during this time his red blood count rose to 4,100,000 and his hemoglobin to 12.2 gm. He showed no further signs of bleeding after his third hospital day, and after six days his stools became brown in color and guaiac-negative.

On December 27, 1949, with the patient under endotracheal cyclopropane and curare anesthesia, laparotomy was performed, revealing an ovoid mass about the size of a large marble just beneath the mucosa in the anterior wall of the duodenum. A small segment of the

anterior duodenal wall including the tumor was excised longitudinally. The duodenum was then closed transversely.

The postoperative course was uncomplicated. Postoperative x-rays revealed an irregular contraction in the first portion of the duodenum approximately 2.5 cm. distal to the bulb. The progress of the barium was unimpeded. The patient was discharged with no complaints on January 16, 1950.

On June 16, 1953, the patient was re-examined and found to be completely asymptomatic. His red blood count was 5,130,000 and hemoglobin 15 gm.

The specimen consisted of an ovoid mass of firm tissue partially covered by mucosa, measuring 1.5 cm. in diameter and 2 cm. in length. On section it was a homogeneous white mass of coarse lobulated tissue.

Microscopically, the tumor was composed of bundles of interlacing fibers of smooth muscle. The nuclei were spindle-shaped and of uniform size. One surface was covered by duodenal mucosa with an intact muscularis. No malignant changes were present.

COMMENTS

Leiomyoma of the duodenum usually arises in the first portion. Only three cases have been reported with origin given in the second portion (our Case 1).[4,8] Some of these tumors are asymptomatic and are incidental findings at autopsy. The nineteen symptomatic proven cases had symptoms varying from vague abdominal distress to massive gastrointestinal hemorrhage. In one case[6] the symptomatology led to a preoperative diagnosis of cholecystitis, but jaundice has not been reported except in our Case 1.

These tumors may occur at any age. The ages of those with symptoms ranged from fourteen to sixty-three years with the symptomatology covering periods of several months to fifteen years.

Roentgenographic study of the upper gastrointestinal tract usually reveals significant changes, although they are seldom diagnostic. In eight of the cases barium study disclosed deformity of the bulb and/or a filling defect. Dilatation of the bulb with retardation of flow, difficulty in filling the duodenal bulb, rapid transit of the barium through the duodenum, and other changes interpreted as mucosal fold defects and duodenal ulcer have been reported.

The majority of these tumors do not project into the lumen of the bowel but extend into the subserosal region. The submucosal tumors are much smaller than the subserosal ones. Necrosis and hemorrhage in the center of the neoplasm gives an increase in size, and the gastrointestinal hemorrhage follows when the sinus connects with the bowel lumen.

The treatment of choice is surgical excision of the tumor. When the tumor is present in the first portion of the duodenum, simple excision is desirable, as in our Case 11. If this is not possible, a duodenal resection must be performed. When the tumor involves the second portion of the duodenum and the common duct, pancreaticoduodenal resection is necessary, as in our Case 1. Of the other eleven in which operative procedures are specified, five[6,8,9] required simple excision, five[4,6,8] duodenal resection and one gastroenterostomy.[8]

SUMMARY

Two cases of leiomyoma of the duodenum are reported. These benign tumors usually occur in the first portion, give deformity or filling defect on roentgenographic study and produce a variety of symptoms, the most consistent being melena, hematemesis and massive gastrointestinal hemorrhage. Most of the tumors project from the serosal surface and not into the lumen of the bowel. The treatment of choice is surgical excision.

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Hemangiomas of the Liver

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ALTHOUGH reports of successful resection of large hemangiomas of the liver are appearing with increasing frequency in the medical literature, the condition is of such rarity that the great majority of surgeons will not encounter such a case in a lifetime of practice. The few that are confronted with the problem, however, may come upon it unexpectedly in the guise of a perforated duodenal ulcer, a gastric neoplasm or as in our case an acute cholecystitis. The outcome for the patient may depend on the ability of the surgeon to make an accurate and rapid appraisal of the possible courses open to him. He must take into consideration the accessibility of the tumor and whether by its nature or due to a complication it is life endangering. Balancing these facts against his knowledge and experience in this field, and the availability of transfusable blood for the patient, he may then resect the tumor, if this can be done safely without excessive hemorrhage, or decide against surgical attack if the circumstances so dictate.

This paper presents to the general surgeon a brief consideration of the problems involved, the pitfalls to be avoided and the well established principles of liver resection, familiarity with which will aid him in his clinical appraisal should he encounter such a case.

The problem in general presented by hemangiomas of the liver is that of a pathologically benign tumor which may by virtue of its increasing size or its fragile vascular composition become of definite symptomatic interest to the patient and to the surgeon. The symptomatology resulting from the mechanical bulk of the tumor may be simply a dragging sensation accompanied by the visible or palpable presence of the mass; or the tumor may produce definite compression either of the gastroduodenal area with pain, nausea, and vomiting,[2,13,14] or of the right kidney and ureter with a history of one or more episodes of urinary infection.[8]

The symptomatology associated with its vascularity usually is more dramatic resulting from spontaneous or traumatic hemorrhage into the tumor itself, producing localized pain and a tender mass, or into the peritoneal cavity,[3] producing the picture of an upper abdominal or generalized peritoneal insult comparable to a perforated peptic ulcer.

It is a commonly recorded clinical observation that many of these tumors undergo progressive enlargement, the patients frequently reporting for treatment only after the symptomatology of several years has finally become too burdensome or when an acute episode of pain or hemorrhage has intervened and converted the chronic state into an emergency situation. It is apparent as well that the initial operative intervention is the golden opportunity in dealing with hemangiomas of the liver. Brunschwig[2] recently recorded a case, biopsied four years previously which for its complete removal necessitated resection of the gallbladder and a portion of the anterior abdominal wall. Caldwell[3] had a similar experience in a patient with a hemangioma of the left lobe of the liver, re-operated one month after biopsy and sutured for control of a spontaneous massive hemorrhage; adhesion formation was so marked that resection was abandoned.

We can state, then, that where the diagnosis of hemangioma of the liver is made, resection of the tumor is the treatment of choice if the tumor is of significant size or has been symptomatic. If resection is impossible, x-ray therapy may decrease the size of the tumor[7,9,10] and produce symptomatic relief, but this may be temporary. Quattlebaum[8] had a case in which he believed that x-ray therapy rendered the tumor more easily resectible.

Once resection of the tumor has been decided upon, there are a few pitfalls to be avoided, and a few principles of resection to be followed

which will aid in the technical performance of the procedure.

The possible errors in handling such tumors are, in general, four in number: (1) inadequate exposure; (2) lack of sufficient transfusable blood; (3) biopsy of the tumor and (4) placing the plane of resection at the edge of the tumor itself rather than beyond.

It will be seen that the first two problems listed are largely circumstantial, usually arising because the possibility of liver resection was not foreseen preoperatively. Because he is operating either for an undiagnosed tumor or for an acute surgical condition of the upper abdomen, the surgeon frequently makes a vertical incision; and in fact the majority of reported resections have been accomplished through such an approach. If, however, the possibility of liver resection can be anticipated, a unilateral or bilateral subcostal incision will afford better exposure. Even if the median or paramedian vertical incision has been made, increased access to the desired area of liver can be obtained either by extending the incision in oblique fashion across the costal margin or by division of the ligamentous attachments of the liver to the diaphragm. The latter maneuver is, of course, essential when a lobectomy is performed; but caution should be exercised in any case because of the possibility of hemorrhage from large collateral vessels in these so called avascular attachments.

A lack of transfusable blood can be rapidly corrected if a well stocked blood bank is in operation; and a few minutes delay in the surgery while blood is made ready is time well spent. Although even the large hemangiomas arising from the liver over a broad area may be resected without blood loss sufficient to require transfusion during surgery (see case report), to recommend that such a procedure be undertaken without blood available would appear unwise.

The last two errors are the consequence of incising directly the vascular spaces of the tumor, either in taking a biopsy for diagnostic purposes, or in performing resection at the wrong site. Hemangiomas of the liver have a characteristic appearance; visualization and palpation of the deep reddish purple, spongy, highly vascular tumor in the intact state should suffice for a diagnosis. If resection is undertaken, initial biopsy is unnecessary; if definitive resection is postponed, the removal of a biopsy greatly complicates the subsequent procedure. In either case bleeding from the biopsy site will be profuse and frequently difficult to control. Shumacher,[11] in summarizing the collective experience with all reported cases of operatively treated hemangioma up until 1942, found that of a total of sixty-seven operated cases, fifty-six were resected, with one death (mortality, 1.8 per cent); while eleven were not resected, with six deaths (mortality, 54 per cent). Of nine cases in which active bleeding from the tumor itself was encountered during surgery due either to previous spontaneous rupture or to incision of the tumor by the surgeon, resection was possible in three cases, all of whom survived; none of the unresected cases survived.

More recently, Riddler and Madding[10] reported a case in which both aspiration and biopsy of the hemangioma were performed without subsequent resection. Hemostasis was secured successfully but with some difficulty by the use of mattress sutures and gelfoam. Subsequent x-ray therapy decreased the size of the tumor and relieved the patient's symptoms.

Bleeding from the hemangioma itself during resection is avoided by placing the plane of incision beyond the limits of the vascular tumor, as will be described in detail.

In contemplating resection of the tumor, its location and anatomic characteristics become of interest. If as in the majority of cases the tumor is in the left lobe of the liver, resection will be easier than for those in the larger right lobe, and ligation of the vessels to the left lobe with total lobectomy may facilitate the procedure. The presence of a narrow pedicle at its liver attachment also simplifies the resection. Wherever the site of the tumor, care should be exercised to place the plane of resection beyond the confines of the vascular spaces of the tumor either in normal liver tissue or in the layer of fibrous tissue which sometimes separates tumor and liver.

After selection of the plane of resection, mattress sutures of heavy chromic catgut are placed across normal liver substance before the tumor is excised. The mattress sutures are supplemented by clamping and ligation of individual vessels and bile ducts, as they are encountered. Further adjuvants to hemostasis are digital compression of the vessels in the hepatoduodenal ligament, and pressure on the oozing surface, with gauze packs or gelfoam. The operative area is always drained. If gauze

FIG. 1A. Operative view of hemangioma of liver. Notice size of tumor in comparison with gallbladder which is located at top of picture.

packing is left intra-abdominally, it is removed in twenty-four to seventy-two hours. The Penrose drain is left in place for several days.

CASE REPORT

A forty-five year old white female was admitted to Hahnemann Hospital on January 29, 1953, with a presenting complaint of pain in the right upper abdominal quadrant of thirty-six hours duration. On the day preceding admission the patient was awakened early in the morning by a severe sharp pain below the right costal margin, steady in character without radiation. There was no nausea or vomiting but the patient was afraid to eat. A physician was consulted who administered a hypodermic injection in the morning and again in the evening of the day prior to admission, with transient relief of pain. Because the pain persisted the patient was admitted to the hospital on the service of one of the authors (W. L. M.).

A review of the patient's previous history revealed no other attacks of pain similar to the present attack. The patient had been subject to chronic constipation but no other digestive disturbances. She gave a history of low back pain for many years and of being treated for "pus on kidneys" two years previously.

Physical examination at the time of admission showed marked tenderness and guarding over the entire right upper abdominal quadrant and right flank, with a palpable tender mass in this area. Pelvic and rectal examination were

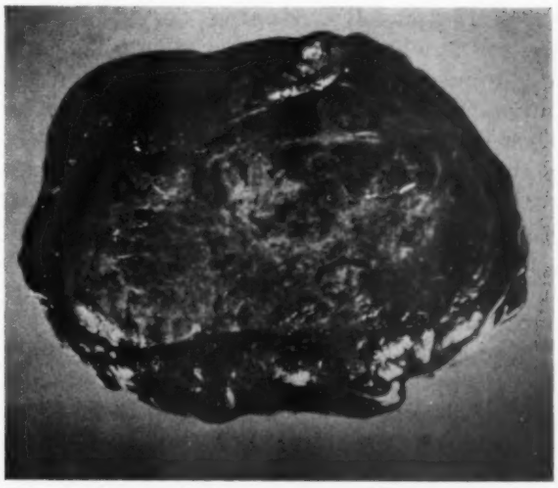

FIG. 1B. The excised tumor, measuring approximately 15 cm. in greatest diameter.

not remarkable. A scout film of the abdomen showed a poorly defined mass in the right upper quadrant which was interpreted as representing either liver or gallbladder. Temperature was 99.6°F., a blood count was within normal limits. A presumptive diagnosis of acute cholecystitis with a markedly distended gallbladder was made, and the patient was scheduled for surgery on the following day. Several hours after admission the patient was re-examined; at that time the abdominal tenderness had decreased and it was possible to delineate a large, firm, irregular, tender mass occupying the entire right upper quadrant and right flank which moved freely with respiration. It was thought that this probably represented liver rather than

gallbladder and the possibility of a primary inflammatory lesion of the liver was entertained.

On January 30th laparotomy was performed. Occupying the inferior portion of the right lobe of the liver and extending well beyond liver surface was a reddish purple firm mass of highly vascular tissue comparable in size to a large grapefruit. (Figs. 1A and B.)

Consultation was held with the surgical pathologist at the operating table and it was believed that the mass represented a hemangioma of the liver, very probably benign in character. It was decided to resect that portion of the right lobe of the liver giving rise to the tumor. Mattress sutures of heavy chromic catgut were first placed across the area of resection and secured. Large segments of hepatic tissue were then clamped and divided, the tissue in the clamps being ligated with heavy chromic catgut. Individual bleeders were seized and ligated; areas oozing blood or bile were included in multiple suture ligatures of chromic gut. Proceeding in this fashion the tumor mass was resected with a minimum of blood loss considering the degree of vascularity of the involved tissues. A large Penrose drain was placed beneath the area of resection to provide exit for blood and bile.

Postoperatively the patient's course was uneventful. Drainage from the wound was comparable in amount with that following a routine cholecystectomy; it was serosanguineous in character; at no time was there discernible drainage of bile. The drain was removed on the fourth postoperative day; drainage had ceased and the wound was completely closed by the seventh postoperative day.

A profile of liver function studies performed postoperatively showed completely normal hepatic function. The resected tumor mass on measurement was 15 cm. in its greatest diameter. Microscopic examination of slides taken from the tumor showed a benign cavernous hemangioma.

SUMMARY

The diagnostic and therapeutic problems associated with large hemangiomas of the liver are presented. When such a tumor is diagnosed, resection at the initial operation is the procedure of choice. Treatment of the unresectible lesion with x-ray may provide temporary symptomatic relief. The pitfalls to be avoided and the principles of resection to be followed when dealing with large primary hepatic tumors are discussed. An illustrative case report is appended.

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Eosinophilic Granuloma of the Rib

A REVIEW OF THE RECENT ENGLISH LITERATURE, WITH A CASE REPORT

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IN the past eosinophilic granuloma of the rib has been described as an uncommon lesion.[12] The author, in a recent report,[9] described two such cases seen within a year. The case reported in this article is the third seen in four years. This experience, as well as the increasing number of reports in the literature, suggests that this type of lesion either is becoming more frequent or is being recognized more often.

In 1935 Fraser[8] adequately described this bone lesion and gave it the name lipoid granulomatosis. Farber[6] in 1941 suggested that the lesion was closely associated with those of Schüller-Christian disease (lipogranulomatosis). Lichtenstein and Jaffe in 1940[13] gave the disease its present name of eosinophilic granuloma and in 1944[11] suggested that it represented an inflammatory reaction caused by an unknown infectious agent. Others suggest that the condition is closely associated with Letterer-Siwe disease (non-lipoid histiocytosis). The consensus appears to be that all three conditions, Schüller-Christian disease, Letterer-Siwe disease and eosinophilic granuloma are variants of the same disease.[3,16]

CLINICAL AND LABORATORY FINDINGS

It was formerly thought that eosinophilic granuloma was primarily a disease limited to children and young adults, and that its occurrence was extremely rare after the age of twenty-five years. Recent reports, however,[3,7,9,10,15,16,19] indicate that this condition occurs commonly in the fourth, fifth and even the sixth decades of life. It is found most commonly in ribs and other flat bones such as those in the skull, scapula, mandible and pelvis. It has also been discovered in the femur and vertebral bodies but has never been reported in the bones of the hand and feet. The disease may occur as an isolated lesion or as multiple lesions, affecting bones[18] and other organs such as the lungs and diaphragm.[1,17] It affects males more often than females.[3] A hereditofamilial tendency, however, has not been demonstrated.[12] History of trauma is uncommon. The symptomatology usually consists of low grade pain over the affected area and may be associated with a mild febrile reaction.[9,12] There is usually swelling and tenderness over the affected area. Less common systemic manifestations include weight loss, anorexia and malaise. If the lesion is observed over a considerable period of time, there is usually a rather rapid progression on radiologic examination.[2] X-ray reveals a fusiform swelling over the affected area with osteolysis of the medullary portion of the bone. The cortex may or may not be affected, but in any case it is usually very thin. Pathologic fractures may occur. Spontaneous healing[4] and cures by x-ray therapy and simple curettage have been reported. Eosinophilia may range from 0 to 11 per cent.[3,5,14] It should be emphasized, however, that histologic examination is necessary in order to establish a definite diagnosis, and excision is the treatment of choice. Eosinophilic granuloma must be differentiated from metastatic carcinoma, simple bone cyst, Ewing's sarcoma, reticulum cell sarcoma, myeloma, lymphoma, osteochondroma, as well as fibrous dysplasia of bone, osteomyelitis and osteitis fibrosa cystica. Obviously, histologic examination is mandatory in order to rule out the aforementioned conditions.

CASE REPORT

A twenty-nine year old white male physician stated that in May, 1953, while lifting a dresser, he developed back pain about the level of the fifth thoracic vertebra. The pain persisted for several days but x-rays revealed no pathologic condition. In June the patient noticed the onset of intermittent right anterior chest pain which

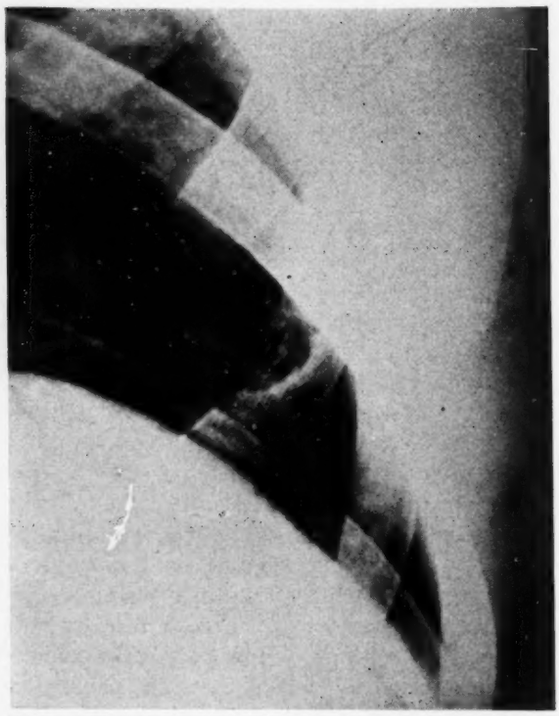

FIG. 1. Roentgenogram demonstrating the osteolytic lesion of the anterior portion of the right sixth rib showing medullary and cortical involvement.

he believed to be related to the previous injury, but x-rays were again negative. On July 18th, because of severe pain, further x-ray studies were made. These showed a lesion in the anterior portion of the right sixth rib. Additional films taken on August 22nd showed a definite increase in the size of the destructive lesion in the rib. (Fig. 1.) Except for pain there were no other complaints.

On physical examination the patient was well developed, well nourished and quite apprehensive but did not appear acutely ill. His blood pressure was 126/70 and his pulse 80. There was a tender area measuring 1 by 2 cm. over the site of the lesion in the sixth rib anteriorly, but no tumor was palpable.

A complete blood count and urinalysis were within normal limits. There was no eosinophilia. Bence-Jones protein test was negative. Excretory urogram was normal. Chest x-ray revealed the lesion in the right anterior sixth rib to have increased in size. It appeared to be a destructive lesion which involved the cortex of the bone. The following report by the radiologist illustrates the uncertainty of the radiologic diagnosis:

"On the anterior portion of the sixth right rib is an irregular osteolytic lesion confined more to the superior portion of the rib than the inferior and containing areas of radiolucency with some areas of sclerosis. There is destruction of the superior cortex. No periosteal reaction and no masses were seen. A metastatic lesion is to receive first consideration. A primary malignant bone lesion of the non-ossifying type may also be considered. An eosinophilic granuloma might give this appearance, although benign lesions are not considered because of destruction of the cortex."

A skeletal survey on admission revealed no other lesions.

On August 28th, using gas-oxygen-ether endotracheal anesthesia, an 8 cm. portion of the involved sixth rib, along with the intercostal muscle bundle and pleura on either side of the rib, was excised *en bloc*. The patient withstood the procedure well and his convalescence was uneventful. A smear of the lesion taken after its removal revealed many pale-staining eosinophils. Stained paraffin section examination was reported as follows:

"Sections taken through the lesion reveal a process which is broken through the outer cortical area at one point and has projected laterally and which descends into the subperiosteal region. The mass of tissue is composed predominantly of an interlacing pattern of fibroblasts which in some instances is quite dense and in others shows some myxomatous and mucinous stroma. This tissue is quite vascular. There is a marked infiltration, somewhat irregular, of eosinophils. There are also present some lymphocytes and plasma cells. The predominating cells, however, other than fibroblasts, are histiocytes and macrophages. Small foci of necrosis can be seen and about these areas are occasional multinucleated foreign-body type giant cells. This process has diffusely infiltrated the bony trabeculae and areas of osteolytic activity are noted. Where this process is subperiosteal in location there is in addition foci of new bone formation."

SUMMARY

A review of the recent English literature on eosinophilic granuloma of the rib is presented. Excision *en bloc* and histologic examination are necessary to differentiate this lesion from other diseases having a similar radiologic appearance and clinical picture.

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Appendiceal Stump Abscess

A REPORT OF STUMP ABSCESS TWENTY-THREE YEARS POSTAPPENDECTOMY

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SURGICAL technic has been considerably standardized on anatomic and physiologic principles. Although some new areas are constantly being probed, in only a short time one procedure is evolved which quickly becomes the choice of the majority of surgeons. This is also true of appendectomy, except for the method of treating the stump, of which the popular technics are: (1) simple ligation, (2) simple ligature with purse-string inversion (burying), and (3) purse-string inversion without ligature. All agree that the stump should not be longer than ½ inch.

Dawbarn[3] in 1895, shortly after the first appendectomy, described eleven methods of treating the appendiceal stump. His preferred technic left the appendiceal stump never longer than ½ inch, which was then invaginated untied. Goode and Kregel[4] objected to the simple tie because the stump does not have serosa-to-serosa apposition. Also, the stump sloughs up to the ligature. On opening the abdomen of their experimental animals four to five days later, very insecure protective adhesions were found over the cecum. The hazard of leakage was judged to be greatest at the third day. Burying the stump seemed as undesirable. Inversion of a short, untied, carbolized stump was preferred. Yeager[1] investigated, in a series of rabbits, the end results of the usual method of treating the appendiceal stump, with the further variations of catgut, silk, phenol and cautery. No superiority of any method could be determined. Rose[9] reviewed thirteen cases of recurrent appendiceal abscesses, two of which were due to incomplete removal, one at two years and the other at one year. Each had 2 inches of the appendix remaining. Ochsner and Lilly[6] have written a classic article concerning treatment of the appendiceal stump. They state that with simple ligature the bowel is inadequately closed, the stump is a source of infection and adhesions are encouraged. Favoring ligation and inverting (burying) the stump, they say serosa-to-serosa approximation is secured. However, there is no doubt about the real danger of cecal wall abscess developing at the ligature. An intramural vessel may be included in the purse-string suture. Since Dawbarn,[3] who objected to previous methods and practiced simple crushing and inversion of the stump, many minor variations have appeared. However, although this method has been championed by many, by no means may it be considered sufficient to have excluded others. Serosa-to-serosa apposition is adequately secured, obviating or certainly minimizing the danger of later leakage. Further, the infected stump is not buried in the cecal wall. Adequate crushing of the stump, absence of infection and careful insertion of the purse-string suture should obviate danger of hemorrhage. The appendiceal artery should be ligated adequately and carefully. Stratte[5] tied the base ⅛ inch from the cecum. Colp[7] further emphasized the danger to vessels in the cecal wall with hematoma formation and secondary interference with blood supply. Baumgardner[10] reported a rupture of an appendiceal stump, treated with simple ligature, three months after appendectomy. A 3 cm. linear tear of the cecum was found. In this case a blowout occurred at the site of an abscess due to persistent infection locally. Kross[8] studied the buried and nonburied stump method in a series of rabbits. He found the most striking feature of the buried stump to be gross hemorrhage, infiltration and ulceration of the cecal wall distal to the purse-string suture, often with direct communication between the lumen of the bowel and the necrotic buried stump. With simple ligation of the stump there was no evidence of hemorrhagic infiltration of the cecum. In both types adhesions were found about the cecum and the

surrounding structures, which were more dense and more numerous where the stump was buried.

CASE REPORT

E. G. (No. 143648), a fifty-one year old white woman, was admitted to the New York City Hospital on July 19, 1946, for pain in the right lower abdominal quadrant. During October, 1945, she had first become aware of this pain which varied from sharp to dull but was constant and non-radiating. Profuse vomiting of a brownish nature occurred periodically, accompanied by anorexia without distention. She was admitted to the surgical service of another hospital for eight weeks where she had a septic temperature, finally being discharged as improved without operation. Recurrence of the same pains (and their persistence for two weeks) required her admission to the New York City Hospital. There was again profuse vomiting without any change in the bowel habits or loss of appetite. She was para 0, gravida 0, her menopause having appeared four years previously. Past surgery consisted of appendectomy in 1932 and hemorrhoidectomy in 1938.

Examination revealed a well nourished, well developed, white woman in no apparent distress, with healthy skin and good color. Blood pressure was 105 mm. Hg systolic, 60 mm. Hg diastolic. The teeth were in poor condition, the mucous membrane dry and the tongue coated. Heart sounds were faint but otherwise satisfactory. The abdomen was obese, distended and diffusely tympanitic. A well healed McBurney appendectomy scar was present, beneath which was a firm, irregular, tender abdominal mass; there was no rebound tenderness. The patient's temperature was 103°F., pulse 96 and respiration 15.

On admission the white count was 27,000 per cu. mm., 88 per cent of which were polymorphonuclear leukocytes. The urine was negative, blood sugar 75 mg. per cent and non-protein nitrogen 29.0 mg. per cent. Mazzini test was negative.

On July 21, 1946, a progress note stated that there was a mass in the right lower quadrant, adherent to skin only and slightly movable. Temperature and blood count indicated infection rather than new growth. There was a history of drainage of appendiceal abscess twenty-five years previously. It was considered that the appendix had been left in and this was an appendiceal abscess.

The patient was treated with intravenous fluids, sulfadiazine, sulfaguanidine and penicillin. Her temperature varied between 103° and 102°F. until July 24th, when it became normal. X-rays of the chest, barium enema and intravenous pyelogram were negative. The upright abdominal film showed a few fluid levels.

Operation on July 31st, through a right rectus muscle-splitting incision, disclosed an appendiceal abscess containing 3 cc. of foul-smelling pus; the stump of appendix ½ inch long contained a fecalith. No information was available as to the type of treatment given the appendiceal stump twenty-three years previously. The subsequent hospital course was uneventful, the patient being discharged to clinic care on August 29th with the drainage sinus almost closed.

On follow-up in October, 1952, the patient was symptom-free. There had been no recurrence of infection or abdominal pain. The abdominal wall was well healed, firm and non-tender, with no evidence of mass.

COMMENTS

Severe complications due to the leakage of an appendiceal stump are occasionally being reported. Perhaps the reports do not indicate the true incidence. It is also possible this complication is responsible for the stormy convalescence rarely seen after appendectomy or for the massive postoperative adhesions found in the right lower quadrant when the abdomen is reopened.[2] Obviously there is no one method for treating the appendiceal stump. Complications have arisen with all methods of ligaturing after removal. Of major consideration must be the degree to which the base of the appendix and the surrounding cecum is affected by the inflammation. It has been the author's observation that the base is not usually involved to a marked or considerable degree, if at all. Where there is inflammation, it is more often periappendicitis rather than a true process through all the coats of the wall. In the general type the simplest method of treatment should be satisfactory, namely, crushing, catgut ligature and carbolation. Where the base is gangrenous, a ligature may not hold. For this eventuality one may crush and invert a short stump. There is no doubt that serosa-to-serosa closure of the bowel is highly desirable to insure the most

favorable healing, since the mucous membrane is a secreting surface and under conditions found in the gastrointestinal tract does not seal itself without the aid of the peritoneum or serosa. However, the stump of the appendix does not lend itself to true inversion by being turned inside out.

In the case presented herein one may inquire why the quiescence of the appendiceal stump was disturbed. This cannot be answered and should not be attempted here for fear of entering the realm of philosophy. Factually, a fecalith and a ½ inch stump was found. It seems apparent that the remaining stump should be no longer than that which is absolutely necessary to hold a ligature. Furthermore, thorough carbolation or cauterization should be practiced. To insure this it would be better to crush only where the ligature is to be tied and not cut between the clamps, tying proximal to the proximal clamp. If one were to cut between clamp and ligature, the stump would remain open and may be adequately carbolized. In this manner we may strive toward aseptic necrosis of the remaining portion.

SUMMARY

A case is presented in which a periappendiceal abscess developed twenty-three years after appendectomy. The intervening period had been uneventful. Etiologic factors were a stump ½ inch in length and a fecalith. Differential diagnosis was between neoplasm, granuloma and abscess. Following simple removal of the stump with ligature and carbolation and abscess drainage, convalescence and follow-up were without incident.

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SURGICAL REVIEW

Primary Carcinoma of the Duodenum

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PRIMARY carcinoma of the duodenum comprises 0.03 per cent of all malignancies and 0.3 per cent of intestinal cancers. Forty-five per cent of the carcinomas of the small intestine arise in the duodenum. Various theories as to its pathogenesis, such as ectopic pancreatic tissue and duodenal polyps, have been propounded, but in the last analysis it is probably due to anaplasia of the duodenal mucosa. For the latter there is no explanation beyond the general carcinogenic factors such as repeated trauma and chronic irritation.

It is surprising that primary carcinoma of the duodenum is not more common. The horizontal portion overlying the third lumbar vertebra is exposed to trauma. The duodenum constantly receives acids, alkalies, bile salts, cholesterol, digestive enzymes, roughage, alcohol and all ingested food and liquids. The marked erosion of the skin associated with duodenal fistulas is ample evidence of the irritative properties of the duodenal contents. Duodenal mucosa makes contact with gastric mucosa, biliary and pancreatic ducts. One-fourth of all aberrant pancreatic tissue is located in the duodenum, and ectopic gastric mucosa is found there occasionally. Polyps and adenomas may undergo malignant degeneration. Considering all these facts, the incidence of malignancy is less than one would expect.

Carcinoma of the duodenum may conveniently be subdivided into three classes, according to its anatomic location: suprapapillary, peripapillary and infrapapillary. It is important to exclude vaterian carcinomas, since these arise in the papilla and should be considered as malignancies of the biliary tract rather than primary carcinomas of the duodenum. In general the growth is circumscribed in vaterian carcinoma, while in peripapillary duodenal carcinoma it tends to develop in an annular or cylindric manner and may involve the entire circumference of the duodenum. Histopathologic examination may make the diagnosis but is not a positive means in highly anaplastic tumors. The differentiation is difficult and at times impossible. The burden of proof is imposed upon the rarer tumor, and therefore malignancies not definitely shown to be of duodenal origin should be classified with those of biliary duct or pancreatic origin.

In 1950, Kleinerman, Yardumian and Tamaki[91] collected the previous analyses of several excellent reports, added sixty-seven cases, and reported 453 proven cases of primary carcinoma of the duodenum, with the anatomic location of each. (Table 1.)

The average age of all reported cases was fifty-five. Males are affected three times as frequently as females.

SYMPTOMATOLOGY AND CLINICAL FINDINGS

The most common symptom is epigastric distress, usually aggravated by food and temporarily relieved by vomiting. A rapid loss of weight, progressive weakness and easy fatigability, and symptoms of secondary anemia are common. Many authors have emphasized the importance of the location of the tumor, pointing out that the vomitus contains no bile with obstructing suprapapillary lesions, and contains much bile with infrapapillary lesions. Dixon,[56] however, ascribes the key symptoms to the morphologic characteristics of the lesion, dividing them into four main groups: (1) obstructing lesions, which present a picture of repeated vomiting and dehydration; (2) ulcer-

ating lesions, which bleed and result in melena and marked secondary anemia; (3) lesions that penetrate into the pancreas and several hours after meals produce a gnawing pain that is not relieved by food or alkali; (4) lesions that encroach on the ampulla of Vater and produce symptoms similar to those of vaterian or pancreatic carcinoma.

Physical examination in the early stages is usually non-contributory. A palpable mass in the epigastrium is not present until late in the disease. Occult blood in the stool is a constant and very important finding. Blood studies usually reveal a microcytic secondary anemia. It is noteworthy that MacKenzie and Miller,[115] in 1949, reported a case in which the diagnosis was made by cytologic examination of cells recovered by duodenal drainage, using the Papanicolaou stain.

There is a considerable difference of opinion regarding the efficacy of x-ray studies. Relatively few cases in most reports were diagnosed by roentgenography. The position of the duodenum, its close proximity to adjacent organs and the rapid propulsion of barium due to its high peristaltic gradient render precise radiographic diagnosis difficult. However, Weber and Kirklin[163] reported that the existence of the lesion was predicted in fifteen of seventeen cases at the Mayo Clinic up to 1939, and that it has been predicted in every instance in the twenty cases occurring at that clinic since 1939. Such terms as "lesion," "filling defect," "cresentic defect" and "intrinsic lesion" were used, it is true, but the anatomic location was specified in all cases. These authors do not advocate a routine examination of the duodenum in all gastrointestinal x-ray examinations, but stress that such should be done if an unexplained obstruction or melena exists, or if the clinician suspects a lesion in this area.

TABLE 1[91]

INCIDENCE AND LOCATION OF PRIMARY CARCINOMA OF THE DUODENUM

Reported by*	Analyzed	Accepted	Suprapapillary	Peripapillary	Infrapapillary
Steward and Lieber (1937)	590	323	63	222	38
Berger and Koppelman (1942)	81	63	14	29	20
Kleinerman, Yardumian and Takami (1948)	72	67	25	17	25
	743	453	102 22.5%	268 59.2%	83 18.3%

* Average age of all reported cases, fifty-five. Males affected three times as frequently as females.

PATHOLOGY

Primary carcinomas of the duodenum are adenocarcinomas derived from duodenal mucosa. The tumor cells are frequently cylindrical, and the microscopic picture may resemble that of carcinoma of the pancreas. In general the tumors vary as do carcinomas elsewhere in the intestinal tract, and logically fall into two main groups: (1) polypoid, medullary fungating tumors, with abundant cells and scanty stroma; (2) scirrhous, annular, stenosing tumors, with abundant stroma and few cells. This type predominates, particularly in the case of infrapapillary carcinoma. Metastasis is practically always lymph-borne to the regional lymph nodes, and fortunately occurs much later than in the case of carcinoma of the stomach or pancreas.

DIAGNOSIS

A definite diagnosis depends upon the clinician's awareness of primary carcinoma of the duodenum, careful evaluation of the clinical picture and radiography. Unexplained occult blood in the stool and obstruction are key findings. Annular pancreas and extraluminal tumors impinging upon the duodenum may cause difficulty, but these do not result in a destruction of the mucosal pattern. One of the author's cases of chronic localized "tumor-like" pancreatitis, involving the head of the pancreas with associated marked chronic duodenitis, was impossible to differentiate prior to surgery. Carcinoma of the papilla of Vater poses no difficulty in the diagnosis of early cases, since it presents the clinical picture of

extrahepatic obstructive jaundice. In 222 cases of vaterian carcinoma collected by Lieber, Stewart and Lund,[101] jaundice was present in all but four instances. In forty-five cases of primary carcinoma of the duodenum, Dixon[56] noted that intestinal obstructive features were prominent in thirty-eight, while anemia was the chief finding in six. If a malignancy of the duodenum is strongly suspected, but cannot be proven clinically, exploratory celiotomy is definitely indicated.

SURGICAL CONSIDERATIONS

Surgical extirpation of the lesion offers the only hope of cure. The tremendous advance in surgery of the duodenum and pancreas during the past fifteen years has provided the hope of a cure of many cases that previously would have been considered hopeless. Brunschwig[25] classified the definitive surgical procedures for carcinoma of the duodenum into three categories: (1) local resection of the tumor; (2) segmental resection of the duodenum, with or without excision of a portion of the adjoining pancreas; (3) pancreatoduodenectomy.

While the mortality of such procedures has remained high, approximating 30 per cent, it is anticipated that it will decrease considerably during the next few decades as a result of improved surgical technic and a better appreciation of the physicochemical requirements of the human organism.

Because of the relatively late metastases and slow growth of a large percentage of these tumors, a shunting operation such as a gastrojejunostomy is well worth while in obstructed cases that come to surgery too late for definitive removal of the carcinoma. Dixon[56] reported two patients living six and seven years, respectively, following such a procedure.

Surgical consensus is that pancreatoduodenectomy is not justified in carcinoma of the pancreas. This dictum very definitely does not apply to primary carcinoma of the duodenum in which pancreatoduodenectomy results in a sufficient number of five-year cures to justify the procedure.

PROGNOSIS

While still grave and viewed with frank pessimism by some authors, the prognosis is gradually becoming more favorable. The comparatively small number of reported cases to date, and relatively short follow-up periods, do not warrant any definite conclusions at this time, and the best available appreciation of the prognosis is to be gained by analysis of recent reports.

Dixon[56] stated that in spite of the surgical difficulties attendant upon the removal of duodenal carcinomas the prognosis was better than for that of cancers of the jejunum and ileum. He reported forty-nine cases from the Mayo Clinic; thirty-seven of the patients had been operated upon as follows:

Mortality: There were eight surgical deaths in thirty-seven procedures (22 per cent) and three surgical deaths in nine definitive surgical procedures (33 per cent).

Surgical procedures and results: pancreatoduodenectomy was performed in four cases (one patient died and three are living at one year, seven months and three months, respectively); segmental resection—four cases, (one patient died at operation, one died at two years, two are living at one and four years, respectively); local excision—one case (patient living at four years); posterior gastroenterostomy—twenty cases (four patients died, average survival twenty-one months, four patients living at seven, six, three and two and one half years account for the long average survival time); anterior gastroenterostomy—three cases; cholecystostomy—two cases (two died, one in seven and one half months); exploration only—eight cases (four died).

In 1946 Brunschwig[25] reported five cases of patients upon whom definitive surgery had been performed, as follows: pancreatoduodenectomy—two cases (one died on the seventh day; one died at three months); local resection, first part of duodenum—one case (died at one year); local resection, second part of duodenum—one case (alive at eight years); local resection, third part of duodenum—one case (alive at three years).

Thus, although these figures present a grim picture, the prognosis is by no means hopeless and some of the excellent results lend hope toward the future.

CASE REPORTS

CASE 1. The patient, M. S. G., a white man, aged forty-four, was admitted to a U. S. Naval Hospital on August 18, 1949, with symptoms of severe anemia. He complained of headaches, occasional blurring of vision, easy fatigability, dyspnea on exertion and tingling

and twitching of his lower extremities. These symptoms had begun in March, 1949, and had gradually increased in severity.

He dated the onset of his present illness to August, 1948, when epigastric pain developed. This pain was intermittent, not related to meals and not associated with nausea or vomiting. He experienced numerous severe colicky exacerbations of this pain. His symptoms persisted and he lost 12 pounds in weight during the ensuing six months. In February, 1949, he was operated upon in a private hospital, and stated that a portion of his stomach was removed because of a duodenal ulcer. His epigastric pain persisted and six weeks later the symptoms of anemia began. He had never noted tarry stools.

He had been physically retired from the U. S. Naval Service in 1946 with a diagnosis of anxiety neurosis. His habits were temperate. His father died at age thirty-five of a tumor of the bowel. Otherwise past history was non-contributory.

Examination revealed a very pale nervous man of about forty-four years of age; pulse 90, blood pressure 110/90. There was a 10 inch vertical right upper abdominal scar and slight tenderness over the epigastrium. Physical examination was otherwise negative.

Laboratory studies revealed 2.7 million erythrocytes per cu. mm. and 7.5 gm. of hemoglobin. The white blood count and differential were normal. The serum bilirubin was 1 mg. per 100 cc. A gastrointestinal radiographic study demonstrated a partial gastrectomy with a well functioning gastrojejunostomy. The afferent loop of the jejunum did not fill with barium. Blood chemistry studies revealed no abnormalities except for a serum protein of 5.5 gm. per 100 cc. The albumin/globulin ratio was normal. The stools were positive for occult blood.

The record of the patient's previous hospitalization was obtained. At the operation in February, 1949, a partial gastrectomy had been performed, a biopsy of a lesion of the duodenum had been taken through a separate incision in the third portion of the duodenum and the biopsy revealed adenocarcinoma.

The patient was prepared for operation by repeated transfusions of whole blood, a high protein diet and parenteral protein hydrolysates.

At operation on September 8, 1949, the following interesting findings were noted. A gastric resection had been performed, with the removal of an estimated one-third of the stomach. A posterior Polya type of gastrojejunostomy existed, with the proximal jejunum anastomosed to the lesser curvature of the stomach. The first part of the duodenum had been closed. On the anterior margin of the duodenum, at the inferior angle of the duodenal sweep, were three silk sutures which had closed the opening through which the biopsy had been taken. The duodenum was involved by a very firm intraluminal tumor which extended from the region of the ampulla of Vater to beyond the ligament of Treitz. This tumor mass was approximately 2.5 cm. in diameter and 13 cm. long, and its firm distal margin was palpable in the proximal jejunum. Although firmly fixed to the pancreas, the tumor was not fixed to the posterior abdominal wall. The liver was grossly normal and there were no enlarged lymph nodes or other evidence of metastases.

The superior mesenteric vein was exposed and was not involved by the tumor. The lesion was considered to be resectable and pancreatoduodenectomy was performed. The common bile duct was divided at its point of entrance into the pancreas. The pancreas was transected 2 cm. to the left of the superior mesenteric vein, the pancreatic duct being divided 1 cm. distal to this line of division. The regional lymph nodes were resected.

The former gastrojejunostomy was left intact to shorten the operative procedure, although only 6 cm. of afferent proximal jejunum projected beyond the lesser curvature of the stomach. An end-to-side choledochojejunostomy was performed over a urethral catheter 2 cm. distal to the inverted jejunal stump. Between this anastomosis and the gastrojejunostomy the pancreas was sutured to the jejunum, and its duct was implanted into a 2 mm. stab wound in the jejunal mucosa by the necrosing suture technic. Neither the common duct nor the pancreatic duct was dilated, and the short jejunal stump added to the technical difficulty. In retrospect it would have been preferable to have taken down the gastrojejunostomy to provide a longer segment of jejunum for the anastomosis of the common bile duct and pancreas. Penrose drains were placed to the sites of the anastomoses and the incision was closed in layers.

Pathologic examination revealed a firm, nodular, irregular intraluminal tumor of the duodenum 12 cm. in length, extending from a point 3 cm. distal to the ampulla of Vater, to the termination of the duodenum. Throughout most of its length, the tumor involved approximately one-half of the circumference of the duodenum, but at one point it was circumferential for a distance of 3 cm., with a luminal opening only 1 cm. in diameter. At two irregularly shaped areas approximately 2 cm. in diameter, the surface of the tumor was eroded, with grayish necrotic margins surrounding an area covered by clotted blood and fibrinous exudate. At one point the tumor had extended through the duodenal wall into the pancreas. Microscopic examination revealed scanty pleomorphic cells in an abundant stroma. Cylindrical dark-staining cells predominated, with an occasional area revealing attempted glandular formation. The nucleoli were large, irregular and deeply stained. Mitoses were scanty. Examination of the lymph nodes revealed no metastases. The pathologic diagnosis was primary carcinoma of the duodenum. The immediate postoperative recovery was satisfactory. However, a jejunal fistula became evident on the eighth postoperative day, and a massive breakdown of the lateral 10 cm. of the transvere incision occurred, accompanied by rep ated abscess formation. It was not possible to determine whether the choledochojejunostomy or the pancreatojejunostomy had broken down, but since roentgenograms revealed the urethral catheter to be *in situ* at the area of the choledochojejunostomy, it was presumed that the area of the pancreatic anastomosis was at fault. All attempts to maintain a positive nitrogen balance were fruitless, since ingested food would pour forth from the jejunal fistula. Consequently a jejunostomy was performed on October 4, 1949. Two Levin tubes were placed in the jejunum distal to the gastrojejunostomy: the first was threaded proximally approximately 10 cm., when its further progress was blocked by angulation of the bowel. It was hoped that siphonage of pancreatic and biliary secretions from the internal area of the pancreatic fistula would be possible with this tube. The second Levin tube was placed distally along the jejunum. Following this operative procedure the patient received continuous slow drip jejunal feeding in addition to parenteral protein hydrolysates and whole blood, and the prime objective in the treatment of duodenal or jejunal fistulas, a positive nitrogen balance, was achieved. The fistula was treated in the following manner: A small urethral catheter was placed into the depths of the fistula, and through this was dripped a concentrated solution of peptone in 0.1 normal hydrochloric acid, at the rate of 15 drops per minute. A larger urethral catheter was introduced superficially into the fistula, and constant gentle suction was maintained with this catheter. With this regimen the fistula healed spontaneously in seven weeks. The patient was discharged from the hospital, feeling well, in December, 1949.

In March, 1950, the patient was readmitted with chills, high fever and the typical findings of obstructive jaundice. An immediate scout film of the abdomen revealed that the previously mentioned urethral catheter at the site of the choledochojejunostomy had not passed and remained *in situ*. During his first night a violent attack of emesis occurred and the patient vomited the section of urethral catheter. The jaundice and its attendant symptoms promptly subsided, and he was discharged from the hospital five days later.

During the ensuing months the patient resumed his occupation, married for the first time and regained all weight lost during the course of his disease, plus 15 additional pounds. (Fig. 1A.) In November, 1950, the patient suffered a recurrence of upper abdominal pain. He was admitted to the hospital in January, 1951, failed in strength rapidly and died in February, 1951, seventeen months following operation. An autopsy revealed massive upper abdominal metastases, involving the regional lymph nodes and liver.

The question that naturally arises is: What would have been the result if pancreatoduodenectomy had been performed at the time of his original operation in February, 1949?

Case 11. The patient, H. P., a white man, aged sixty-five, was admitted to a U. S. Naval Hospital on December 2, 1949, complaining of epigastric pain, weakness, easy fatigability and a weight loss of 25 pounds. He dated the onset of his present illness to June, 1949, when vague epigastric distress ensued. Gradually increasing in severity, this pain bore no relation to meals and was not relieved by food or soda. He had experienced frequent postprandial sour

1A 1B

FIG. 1. A, (Case 1) ten months postoperatively; B, (Case II) seven months postoperatively.

eructations, but had been nauseated and had vomited on only two occasions. In November, 1949, he had noted tarry stools on three occasions. His past history was non-contributory.

Physical examination revealed a pale, slightly jaundiced, undernourished man of about the stated age; temperature 98.4°F., pulse 84, blood pressure 138/85. There was mild tenderness over the epigastrium but no masses could be palpated. Sigmoidoscopic examination disclosed no abnormal findings.

Laboratory studies revealed 3.2 million erythrocytes per cu. mm. and 8.5 gm. of hemoglobin. The white blood count and differential were normal. The serum bilirubin was 1.8 mg. per 100 cc. The serum protein was 5.2 gm. per 100 cc. The albumin/globulin ratio was normal. The stools were positive for occult blood. X-ray examinations of the chest and large bowel following a barium enema, and a cholecystogram were negative for pathologic findings. A gastrointestinal radiographic study revealed a complete absence of the mucosal pattern and an indefinite irregular filling defect 4 cm. in length along the posteromedial surface of the duodenum at the junction of its second and third portions.

A diagnosis of carcinoma of the duodenum was made. The patient was prepared for operation by repeated transfusions of whole blood, a high-protein, high-carbohydrate diet, and parenteral protein hydrolysates.

Operation was performed on December 15, 1949. The liver, gallbladder, spleen, stomach, jejunum, ileum and colon were normal, and there was no evidence of enlarged lymph nodes. A mass involving the duodenum at the junction of its second and third portions appeared to involve the anterior wall for a distance of 4 cm. but the main mass apparently involved the posterior duodenal wall and the head of the pancreas in this area. The entire mass was freely movable. The tumor was inspected through a 4 cm. incision in the second portion of the duodenum. A fungating lesion, grossly characteristic of carcinoma involved the posterior and medial walls of the duodenum for a distance of 4 cm. The incision in the duodenum was closed.

A pancreatoduodenectomy was performed, with resection of the distal one-third of the stomach. The pancreas was transected at the level of the superior mesenteric vein. The pancreatic duct, which was dilated to 1 cm. in diameter, was divided 1 cm. distal to the point of division of the body of the pancreas. The common bile duct, approximately normal in diameter, was divided at its point of entrance into the pancreas. The jejunum was divided 2 cm. distal to the ligament of Treitz. The regional lymph nodes were removed.

The anastomoses were performed as follows: The jejunum was brought through the operative rent in the transverse mesocolon, and an end-to-side choledochojejunostomy was performed 2 cm. distal to its closed proximal end. A No. 14 French urethral catheter was placed into the pancreatic duct, secured by a silk ligature around the duct and catheter, and was introduced into the jejunum through a stab wound 4 cm. distal to the site of the anastomosis of the common duct. The divided body of the pancreas was sutured to the jejunum with interrupted silk sutures. A posterior Hofmeister type of gastrojejunostomy was performed 5 cm. distal to the pancreatojejunostomy, closing two-thirds of the gastric stoma on the lesser curvature side and anastomosing the remainder. Penrose drains were placed in Morrison's pouch, to the areas of the choledochojejunostomy and pancreatojejunostomy, and the abdominal incision was closed in layers. The patient received a total of 1,500 cc. of whole blood during the operation, and his condition was satisfactory throughout the procedure.

Pathologic examination of the surgical specimen revealed a fungating tumor mass involving from one-half to three-fourths of the circumference of the duodenum over a distance of 5 cm. The tumor mass extended 1 cm. proximal to the ampulla of Vater along the medial side of the latter, and impinged upon but did not surround the ampulla. The orifices of the bile and pancreatic ducts were patent. The anterior wall of the duodenum along this area was thickened and chronically inflamed but was not involved by the tumor. No evidence of penetration through the duodenal wall into the head of the pancreas could be demonstrated.

Histopathologic examination revealed an abundance of cylindrical, irregular, hyperchromatic cells exhibiting bizarre attempts at glandular formation, in a scanty stroma. Mitoses were numerous. The lymph nodes were negative for metastatic carcinoma. The pathologic diagnosis was primary carcinoma of the duodenum.

The postoperative course was satisfactory except for an excessive amount of bile-stained drainage from the incision. On the tenth postoperative day intestinal contents were noted in the drainage, and it was apparent that a jejunal fistula existed. A urethral catheter was introduced into the depths of the sinus tract, and through this a concentrated solution of peptone in 0.1 normal hydrochloric acid was dripped at the rate of 15 drops per minute. Constant mild suction was applied to a urethral catheter placed in the superficial margin of the fistula, and the skin was protected with a layer of aluminum paste in lanolin. Ten days of this treatment resulted in no decrease in the size of the fistula nor in the drainage thereof, and it was impossible to maintain a positive nitrogen balance.

On January 5, 1950, a jejunostomy was performed through a separate vertical incision on the left mid-abdomen. A Levin tube was placed into the jejunum, using the Witzel technic. Following this procedure the patient received continuous slow-drip jejunal feedings, in addition to parenteral protein hydrolysates and occasional transfusions of whole blood. The local measures against the fistula were continued, and it healed spontaneously four weeks later. The jejunostomy tube was removed on February 14, 1950, and the patient was discharged from the hospital, feeling well, on March 8, 1950.

Follow-up examination of the patient in July, 1950, (Fig. 1B) revealed that he had regained all but 10 pounds of his former weight and had no complaints.

The patient has been examined at six-month intervals since his operation. The last examination on February 11, 1953, revealed no evidence of recurrence of the malignancy.

SUMMARY AND CONCLUSIONS

1. Primary carcinoma of the duodenum is discussed.

2. A succinct review of the literature stressing the incidence, surgical considerations and prognosis of carcinoma of the duodenum is included.

3. Although the prognosis of this disease is grave, the results obtained to date justify the employment of radical definitive surgical procedures.

4. Two cases, one of peripapillary and one of infrapapillary primary carcinoma of the duodenum are added to the literature.

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BROWN ET AL. studied over 150 cases of pelvic tuberculosis and conclude that the infection is blood-borne and "descending" in type, in that the infection involves first the peritoneum and tubes, then the endometrium and cervix, and finally the vagina. Thus it is not contracted like a venereal disease. In patients with a pulmonary lesion and pelvic inflammation, if the latter does not subside with the usual treatments, one ought to suspect tuberculosis; also in virgins with pelvic inflammation. Treatment varies; the average case does well on general medical measures including streptomycin and para-aminosalicylic acid plus surgery. (*Richard A. Leonardo, M.D.*)

Spontaneous Intraperitoneal Hemorrhage

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DEFINITE evidence of intraperitoneal hemorrhage is generally considered an indication for laparotomy. One expects to locate and ligate the bleeding vessel, thereby curing the patient. Occasionally this is extremely difficult and sometimes impossible. Since a high mortality rate is associated with uncontrolled hemorrhage, any study which may aid in lowering this mortality should be of interest. This article was undertaken with that idea in mind.

MATERIAL

Since 1909 when Barber[1] presented a questionable case, sporadic cases of spontaneous intra-abdominal hemorrhage have been reported from several clinics in this country and Europe. Tanna's[2] review in 1947 covered thirty-five cases, including three of his own. In 1948 Brewer and Marcus[3] offered summaries of a fairly long list of cases. Although most of these had been a part of Tanna's report, the latter series did add four new cases. Darling[4] described abdominal apoplexy in a patient in 1950, and Wolskel[5] recorded a similar case in 1952. Adding to these cases three from the Harlem Hospital, in which two were operated upon by one of us (C. H. W.) a total of forty-four is reached. Summaries of our three experiences and an analysis of the entire group constitute the material for this study.

CASE REPORTS

CASE I. C. M., a sixteen year old girl, was admitted to the hospital on July 8, 1943, complaining of low abdominal pains of six days' duration.

Illness had begun on July 2nd and was characterized by low abdominal pains, especially on the right side. The pains were constant and had increased steadily since the onset. Although nausea was noted several times, there had been no vomiting. Appetite was good until two days before admission. Laxatives were required. A review of the systems revealed no significant findings. The last menstrual period was normal and on time. The patient had undergone tonsillectomy in 1938.

On admission the patient's temperature was 100.0°F., pulse 92 and blood pressure 108/72 There was no apparent distress. Heart, lungs and breasts were not remarkable. Palpation of the abdomen revealed tenderness over the entire lower portion; splinting and rebound tenderness were found over McBurney's point. There were no masses, and the percussion note was tympanitic. A diagnosis of appendicitis was made and laparotomy was performed.

Approximately 100 cc. of blood were found in the peritoneal cavity. The uterus, tubes and ovaries appeared normal. The appendix was grossly normal. Despite careful exploration of the abdominal viscera, the source of the bleeding was not found. A prophylactic appendectomy was performed. The abdomen was closed without drainage. The postoperative course was uneventful and the patient was discharged on the eleventh day following surgery.

The patient was readmitted to the hospital on September 21, 1943, with pain in the right lower quadrant which began soon after her discharge and persisted. The physical and laboratory findings at this time were within normal limits. She was observed for twelve days, during which time her symptoms gradually subsided.

CASE II. C. W., a thirty-eight year old housewife, entered the hospital on October 8, 1952, because of abdominal pains, dizziness and fainting.

Her last menstrual period had occurred on September 4, 1952, and was normal. When the October period failed to appear on schedule, the patient inserted a catheter in her "womb" on October 5th. She denied injuring herself with the catheter, having become proficient in its use by several previous successful insertions. The catheter was removed after five hours and scant bleedings followed. She was entirely free of symptoms for the next two days. On October 7th moderate abdominal pains began that rapidly grew worse. Dizziness and, later, faintness accompanied the pain.

Past history revealed the patient had had three normal deliveries and three abortions. She denied any operations or serious illnesses.

On admission physical examination showed a moderately obese female in respiratory distress, anxious and pale. Her blood pressure was 90/50, pulse rapid (120) and weak, and hemoglobin 30 per cent. Urinalysis was negative. The significant physical findings were abdominal distention, rebound tenderness and shifting dullness. The cervix was soft, closed and tender to motion. The uterus was estimated to be the size of a six to eight week gestation and slightly soft. Both fornices were full and tender; no masses were palpable. Slight uterine bleeding was noted. A diagnosis of ruptured ectopic pregnancy was made and laparotomy followed.

At operation approximately 2,000 cc. of blood were found in the peritoneal cavity. The uterus, of approximately eight weeks' size, was firm and nodular. The right tube was reddish blue and its distal half presented a fusiform swelling to twice its normal size. The serosa of the tube was intact and no blood was seen coming from its fimbriated end. A clear, thin-walled cyst measuring 5 by 4 cm. largely replaced the right ovary. The opposite tube and ovary were grossly normal. After the blood was removed, the abdomen was explored at great length; but no bleeding vessel was found. The patient's position was altered several times to reveal repooling of blood. None reaccumulated. A right salpingo-oophorectomy was performed and the abdomen was closed without drainage. Pathologic diagnoses of chronic salpingitis and corpus luteum cyst were received. A careful search for evidence of pregnancy in the tube was fruitless.

Slight uterine bleeding persisted during the postoperative period and a diagnostic curettage was performed on the ninth day, yielding fragments of endometrium in the proliferative phase. The patient was discharged on the thirteenth day. At no time was there evidence of recurrent intra-abdominal hemorrhage. Her course in the follow-up clinic had been normal.

Case III. D. F., a twenty-two year old woman, entered the hospital on January 6, 1953, complaining of severe abdominal pains and vaginal bleeding.

The abdominal pains had begun a few hours after a slight jolt on January 1st and had increased steadily since that time. On two occasions dizziness was experienced but she did not faint. The possibility of pregnancy was admitted; interference was denied. Vaginal bleeding started soon after the pains but was never profuse.

On admission the patients' blood pressure was 130/90, hemoglobin 42 per cent, sedimentation rate 3 mm./30 min., temperature 100.2°F. and pulse 90/min. The patient appeared uncomfortable but was in no distress. Examination of the breasts, heart and lungs was not remarkable. The abdomen was distended, tense and tender, with rebound phenomena. The presence of fluid could not be ascertained by percussion.

The cervix was closed, soft and tender to motion. Uterine enlargement was estimated as the size of an eight-week gestation; the corpus was soft and tender. What was felt to be a mass in the right fornix could not be definitely distinguished from the uterus. The diagnostic impression was ruptured ectopic pregnancy, but threatened abortion with early infection was considered. The following day a cul-de-sac puncture was performed which yielded old blood. Certain that our original diagnosis of ruptured ectopic pregnancy was confirmed, laparotomy was immediately performed.

Approximately 400 cc. of liquid and clotted blood were found in the peritoneal cavity. The uterus was ten to twelve weeks in size, soft and regular. Both tubes and ovaries appeared normal. A corpus luteum of pregnancy was present in the left ovary. When the blood was removed, the abdominal cavity was explored as thoroughly as possible without disturbing the gravid uterus unnecessarily. Except for a small, partially organized clot adherent to the sigmoid, nothing unusual was found. Upon removal of this clot the bowel

serosa was normal. No bleeding vessel was found.

The postoperative course was uneventful. Follow-up examinations revealed that the patient was gestating normally. There was no further evidence of recurrent abdominal hemorrhage. She subsequently had a normal labor and puerperium.

COMMENTS

Sobel's[8] experience with an unpublished case of spontaneous intraperitoneal hemorrhage is also of interest. The source of the bleeding was not found during the first operation. After the abdomen was closed, the patient went into shock again, requiring a second operation. The uterus was grasped at each cornu and pulled upward and forward until no wrinkles remained in the broad ligament. Only then was he able to visualize an actively bleeding vessel at the base of the broad ligament posteriorly. It was ligated and the patient recovered.

Etiology and Pathogenesis. Approximately two-thirds of the reported cases were associated with high blood pressure. The elevated pressure was held responsible in these instances. Pregnancy is considered a causative factor in some cases. Zummo, Williams and Uznanski,[7] in their excellent treatise on retroperitoneal hemorrhage as a complication of pregnancy, state that the changes in hemodynamics which occur during pregnancy and labor, with their added stress and strain, may cause spontaneous rupture of weakened vessels. It is their opinion that neither the parity nor the period of gestation is of any importance. Our third case might well fit into this category. Although the majority of the patients were middle-aged and elderly, no age is immune. The youngest case reported so far was that of Cathala, Sorrel and Alison,[6] a four year old child who died following massive intraperitoneal hemorrhage complicating typhoid fever. The source of the bleeding was not found. The sex distribution of this disease is apparently not significant. More men have been affected then women, in a ratio of 2:1.

Pathology. Microscopic examination of the ruptured vessels in many of the fatal, hypertensive cases showed the vascular changes of that disease. It was suggested in some instances that an arteriosclerotic plaque, by preventing retraction of the ruptured vessel, might have favored the fatal outcome. An examination of the operative and autopsy findings of the reported cases reveals the following sites of ruptured arteries:

Left gastric	7	Right and left gastric	1
Superior mesenteric	5	Middle colic	2
Right gastric	2	Right colic	1
Gastroduodenal	2	Splenic	1
		Inferior pancreaticoduodenal	1

Unlike the experience of Zummo et al. mentioned heretofore, where the renal and splenic vessels were the sites of rupture, only the splenic vessel was involved once. Moreover, pregnancy was associated only once in the aforementioned series.

Sixteen of the forty-four patients died, giving an over-all mortality of 36.3 per cent. Eighteen patients were explored surgically and the source of bleeding was not found. Seven of these died, a mortality of 39 per cent. A group of twenty-four patients was operated upon and the bleeding vessel was found. Seven or 29 per cent of these failed to survive. Two patients were not operated upon and both of them died. Thus, as is to be expected, the chances of survival are significantly increased when the bleeding vessel is found and secured.

Diagnosis and Treatment. Spontaneous intraperitoneal hemorrhage must be differentiated from all the acute surgical emergencies of the abdomen. One of our cases, like that of Darling, was misdiagnosed as appendicitis. We diagnosed our last two cases as ruptured ectopic pregnancy, an understandable error since we operated upon 511 cases of ectopic pregnancy during this ten-year period. To some of the earlier authors the condition simulated acute pancreatitis, ruptured ulcer and dissecting aneurysm of the aorta. In the female one must consider a ruptured follicle in the differential. The diagnosis was made preoperatively only twice in the foregoing forty-four cases.

Nearly all of the cases presented an acute onset with varying degrees of shock. Abdominal tap, cul-de-sac aspiration and hematocrit studies are useful diagnostic aids. The treatment is surgical. A systematic exploration of the abdomen after all the blood has been removed should include the aforementioned branches of the abdominal aorta. The spleen must be carefully examined. If the patient can

be brought out of shock while the abdomen is open, the chances of finding an open vessel are increased. Facilities for autotransfusion should improve the patient's chances for survival considerably.

SUMMARY AND CONCLUSIONS

1. Three cases of spontaneous intraperitoneal hemorrhage have been presented, bringing the total reported cases to forty-four.

2. A brief analysis of the reported cases was given.

3. The findings suggest that if the patient can be brought out of shock before the abdomen is closed, the chances of finding the source of the hemorrhage are enhanced.

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Aneurysm of the splenic artery is a very rare condition. The patient may have pain, splenomegaly and a pulsating tumor. When encountered unruptured, splenectomy and removal of the aneurysm is indicated. If discovered only after rupture in a patient who is not a good surgical risk, simple proximal ligation of the artery may suffice. (*Richard A. Leonardo, M.D.*)

Pelvic Eventration Corrected by Vaginal Hysterectomy and Repair

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PELVIC eventration is a condition rarely seen during surgical practice. The term eventration is defined as a protrusion of the bowels from the abdomen. In pelvic eventration there is herniation of the bowel through the vagina and descent of the uterus, bladder, rectum and lower sigmoid as well. Such cases, obviously, are of long duration and not seen frequently. The literature discloses few case reports or suggested methods of treatment.

Adams[1] presented a number of cases in which the uterus had either been partially or totally removed prior to the development of the pelvic eventration. These lacked a complete uterus and differed in this respect from the case reported herein. In his paper he recommends complete closure of the vagina. Presented herein is an unusually serious case in which there had been no previous pelvic surgery. There was a complete uterine procidentia, accompanied by extensive herniation of the small and large bowel through the vagina as shown in Figure 1. This patient was treated by vaginal hysterectomy, with plastic repair of the vaginal walls. The vagina was thus preserved. Examination three years after operation disclosed that the vagina was well supported. The patient had good urinary control and no discomfort during intercourse. The vagina was of adequate depth, with the vaginal apex well supported.

CASE REPORT

B. J., a fifty-six year old woman, had been married twenty-six years. She had been delivered of two children whose ages were twenty-four and twenty-two years, respectively. The last "regular" menstrual period had occurred at age fifty-four. Her chief complaint was that she had been bleeding "every once in a while for the past 2 years," and that she had been "torn with the first child." She also stated that a "dropping out of the insides" began soon after the first delivery and became worse during the two years preceding my first examination on November 7, 1949.

Physical examination revealed a white woman, 5 feet 4 inches tall, weighing 185 pounds. The general examination was negative, except for obesity. The vaginal examination disclosed the presence of a large mass, almost the size of a cocoanut, protruding between the thighs. It measured 8 inches from the urethra to the exposed cervical os, the most dependant portion, and was 16½ inches in circumference. In order to reduce the entire mass it was necessary to introduce the closed fist into the vagina and then force the contents upward. The mucous membrane was very dry and there was much flaking of the surface. During the examination the patient stated that she had no pain when the mass was out, but that it was painful

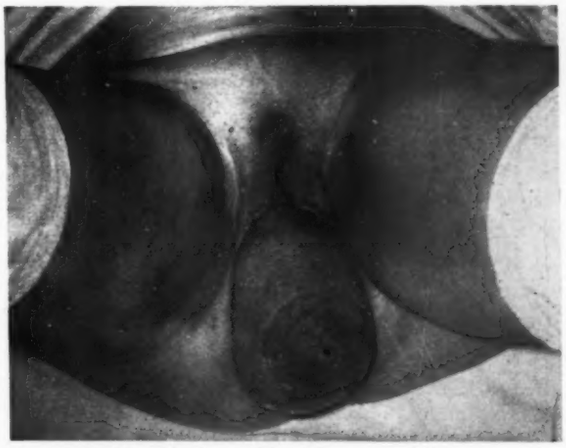

FIG. 1. Patient B. J., age fifty-six—two children; symptoms of twenty-four years' duration; complete "dropping out" for past ten years. Mass is 16½ inches around; 8 inches from pubis to cervical os. Marked leukoplakia of vaginal mucosa; correction of condition accomplished by vaginal hysterectomy and plastic repair.

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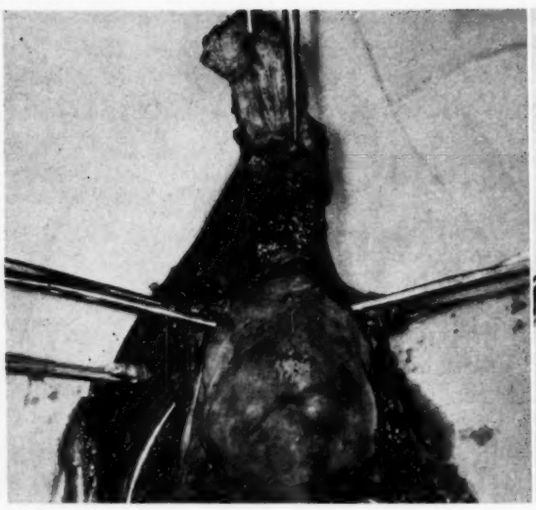

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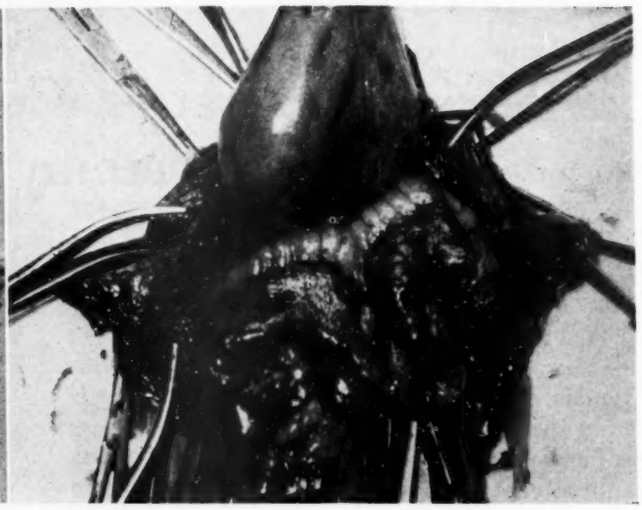

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FIG. 2. The uterus has been inverted. Fibroids and lengthened cervix are readily seen.

FIG. 3. The uterus has been removed. Intestinal contents of posterior cul-de-sac hernia are exposed. The anterior hernia sac has not yet been opened.

after it had been reduced. The mass resembled a large hydrocele when it protruded between the patient's legs while she was standing.

Operation was performed on November 17, 1949, at the Allerton Hospital (Case No. 43708). A vaginal panhysterectomy was performed, accompanied by reduction and repair of the vaginal hernias, anterior and posterior colpoperineorrhaphy. The uterus was enlarged and contained fibroid tumors. (Fig. 2.) Figure 3 discloses the large amount of bowel which had herniated through the anterior sac. Two large hernial sacs were encountered during the dissection. One, anterior to the bladder, consisting of stretched-out peritoneal bladder reflection and a second, composed of the stretched peritoneum of the posterior cul-de-sac. Each contained numerous loops of small intestine and in addition, the posterior sac contained a large portion of sigmoid. The submucosal veins were enlarged throughout, each almost to the size of a pencil. Much bleeding resulted from dissection of these veins. The patient, therefore, received 4 pints of blood during the course of surgery. At the termination of the operation, her pulse was 90 and blood pressure 110/60.

The pathologic findings were as follows: (1) leiomyomas; (2) marked leukoplakia of the cervix with chronic cervicitis and endocervicitis; (3) atrophic endometrium; (4) marked leukoplakia of the vaginal mucosa.

The postoperative course was reasonably uneventful. The day following the operation the patient was in good condition and comfortable. On the fourth postoperative day she passed some blood by rectum. Examination disclosed this to be coming from an area of ecchymosis between the lower rectal and vaginal walls. On the tenth postoperative day a small rectal sinus was noted. In all probability this developed as a result of the wide dissection and interruption of blood supply in this portion of the vaginal mucosa. The sinus healed satisfactorily and spontaneously within ten days. The patient was discharged from the hospital on the twentieth postoperative day. This prolonged stay was partly at the patient's request since she had no help at home.

The postoperative care was no different in this case than that which I usually follow after vaginal hysterectomy. The patient received penicillin for the first three days. The self-retaining catheter was left in place for five days and then removed. Since she did not void readily, the catheter was replaced after three catherizations at six-hour intervals. It was removed forty-eight hours later and there was no further difficulty on her part in voiding.

Occasionally, after the removal of the inlying catheter, some patients will not be able to void satisfactorily. This inability seems to be accounted for by the following reasons. It has been pointed out[2] that the fresh incision in the region of the urethra is almost always associated with spasm of the musculature. This

occurs in sensitive individuals. Such patients develop an inability to use the muscles of the pelvic floor postoperatively.

The other reason seems to be that the bladder has learned how to function in its cystocele position and after it has been returned into the abdominal cavity it requires "education." This nerve muscle mechanism varies in degree in different patients and seems unrelated to the amount of surgery performed. Explanation of this phenomenon will reassure the patient and make the waiting period, until she voids normally, easier for her. The nerve muscle mechanism referred to may be stimulated, while the catheter is in place, by clamping it shut for two hours and releasing it for the same period of time. The patient is instructed how to do this and continues this procedure for most of the twenty-four to thirty-six hours prior to its removal. This measure is effective in many cases. Intramuscular injections of Doryl®,* urecholine®† or pituitary extract®‡ will be helpful, when necessary, to help contract the bladder.

There are some patients, however, who will still require assistance because of severe dysuria resulting from a chronically infected bladder. In this group various medications have been used. Some have benefited by the introduction of 5 cc. of 10 per cent argyrol solution or sterile mineral oil into the bladder. Either seems to overcome the dysuria and often permits the patient to void without difficulty. Considerable relief is obtained by some from the administration of 10 minims of sandalwood oil§ given in capsule form at about four-hour intervals.

True cystitis is proved by bacteriologic examinations and treated by daily irrigations and the various antibiotic or sulfa drugs, depending on the organism found. This patient responded satisfactorily to the use of sandalwood oil and intramuscular injections of doryl.

Discharge from the vagina may occur after the sixth or seventh postoperative day. In this case it was yellowish gray in color and was probably due to the quantity of suture material used. It was readily controlled by douches. The patient was troubled slightly by distention, for forty-eight hours only, beginning on the second postoperative day. This was readily corrected by the use of a rectal tube. Otherwise her postoperative course was comfortable and consistent with the lack of symptoms generally found following vaginal hysterectomy.

The first postoperative office examination was performed on January 5, 1950. At this time examination disclosed the vagina to be of ample depth, the apex well supported, with satisfactory healing in these regions. Some granulation tissue was present in the upper portion of the vagina. This was cauterized with solution negatan.®* There was some mucosal separation in the posterior wall of the vagina at the introitus. This did not disturb the patient. The next examination was on March 14, 1950. A piece of granulation tissue about the size of a strawberry was noted. This was removed with a curet. The procedure, as usual, was painless. The last examination was on June 4, 1952, and the findings were similar to those of the previous examination.

When this patient was first seen the question of which surgical procedure to employ was considered. There were three courses that could possibly be followed. The first was a combined operation of vaginal plastic and abdominal approach. This seemed to be a hazardous undertaking, especially in an obese patient in whom 8 to 10 feet of bowel had prolapsed through the vagina. It seemed that it would be difficult to draw the small bowel out of the hernial sacs back into the abdomen and then perform a suspension, if the uterus was in good enough condition to permit this. The second method which came to mind was a total closure of the vagina. This did not seem to be the proper choice because of the evident presence of leukoplakia involving the cervix and vaginal mucosa and because the uterus was enlarged due to the presence of fibroids. The third method considered and used was that of vaginal hysterectomy accompanied by repair. This approach was preferred because vaginal hysterectomy has proved to be a method by which shock, postoperative infection, thrombophlebitis, embolism, postoperative pneumonia and cardiac upsets are almost unknown.[3] In addition, it was considered because numerous surveys collected from the literature disclosed

* Doryl (Carbachol U.S.P.), Merck & Co., Rahway, N. J.

† Urecholine Chloride (Urethane of β-beta-methylcholine chloride), Merck & Co., Rahway, N. J.

‡ Pituitary Extract (double strength U.S.P.), Upjohn Co., Kalamazoo, Mich.

§Santal Oil (plastic filled capsules-East Indian), Eli Lilly & Co., Indianapolis, Ind.

* Solution Negatan (Negatan), Eli Lilly & Co., Indianapolis, Ind.

a mortality rate of 0.18[4] to 0.31 per cent[5] for this operation. These figures probably represent the lowest mortality rate for any type of major surgery and indicate the safety of the method. The literature[6] also abounds with references to the obese, diabetic, cardiac, cardiorenal and debilitated patients who have received the benefits of vaginal hysterectomy. Not so much can be said for the abdominal approach. It is probable that many patients with such medical conditions complicating the gynecologic problem have not had the benefit of surgery because of the strain and shock of the abdominal approach.[7]

The author has surveyed elsewhere[8] 129 vaginal hysterectomies accompanied by repair. This number was taken from a much larger group of operations performed by him because an adequate follow-up was obtained. Of this number there were two who had worn pessaries for two years, three for four years, one for nine years, one for ten years and one for nearly twenty-five consecutive years. None of these developed carcinoma of the cervix in spite of the use of a foreign body for such long periods of time. The patient reported in this paper had had a "dropping out" of the described mass for almost twenty years. During most of that time the cervix and adjacent mucous membrane had rubbed against her undergarments and in addition, during the past two or three years, she nearly always sat directly on the mass. Therefore, it would seem that such trauma should have permitted the development of carcinoma; yet it is an interesting fact that others have reported similar trauma to the cervix without the development of malignancy.

In the group studied only those with first degree uterine prolapse had a loss of urine. This patient, like so many of those with complete procidentia, did not complain of such symptoms. This was probably due to the "knuckle"[9,10] formed in the urethra by the vaginal eversion and was sufficient to prevent such a symptom. In the group of cases referred to there were no deaths during the hospital stay. Phlebitis or embolism did not develop in any patient. None suffered from peritonitis, paralytic ileus or distention, beyond a slight amount. Cardiac and diabetic patients were not disturbed by the operation and, as in the younger group, the aged withstood the operation without shock or difficulty.

SUMMARY

A case of pelvic eventration is presented which was corrected by vaginal hysterectomy and repair. Reference is made to a survey of 129 vaginal hysterectomies performed by the author and reported elsewhere.[8] It is noted that vaginal hysterectomy is a "complete operation," since by this method the uterus and cervix can be completely removed; a cystocele, rectocele and enterocele can be repaired, and as in this case, a complete pelvic eventration corrected. Vaginal hysterectomy with or without vaginal plastic is an operation practically free of thrombosis, embolism, abdominal peritonitis or paralytic ileus.

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Treatment of Acute Compression Fractures of the Spine with Extradural Analgesias

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EXTRADURAL analgesia was introduced by Sicard[1] and Cathelin[2] in 1901, when they described the technic of injecting anesthetic solutions through the sacral hiatus. At this time the primary intention in the use of the method was for therapeutic rather than anesthetic purposes. However, in 1909 Stoeckel[3] applied the method to obstetrics, and others applied it in surgery of the lower limbs and pelvis. It was not until 1921, when Pages[4] reported forty-three cases, that the lumbar extradural approach was seriously attempted. Pages' work received little attention, and in 1930 Dogliotti[5] independently described this method. It was a technic similar to that used by Pages, and he had a series of more than 10,000 cases. Meanwhile, continuous methods of administration were being considered and in 1940, Lemmon[6] introduced a malleable needle of German silver for administering continuous spinal analgesia. Tuohy[7] had attempted to pass ureteral catheters through a wide bore needle into the subarachnoid space, but because of technical difficulties, the idea was not actively pursued until a Huber pointed needle was employed. This allowed catheters of different sizes to be passed through the needle, either into the extradural space or the spinal canal, and made a difficult technical feat a practical method. The technic was further developed by Hingson and Southworth in 1946[8] and enabled analgesia to be maintained indefinitely by serial injections through the catheter.

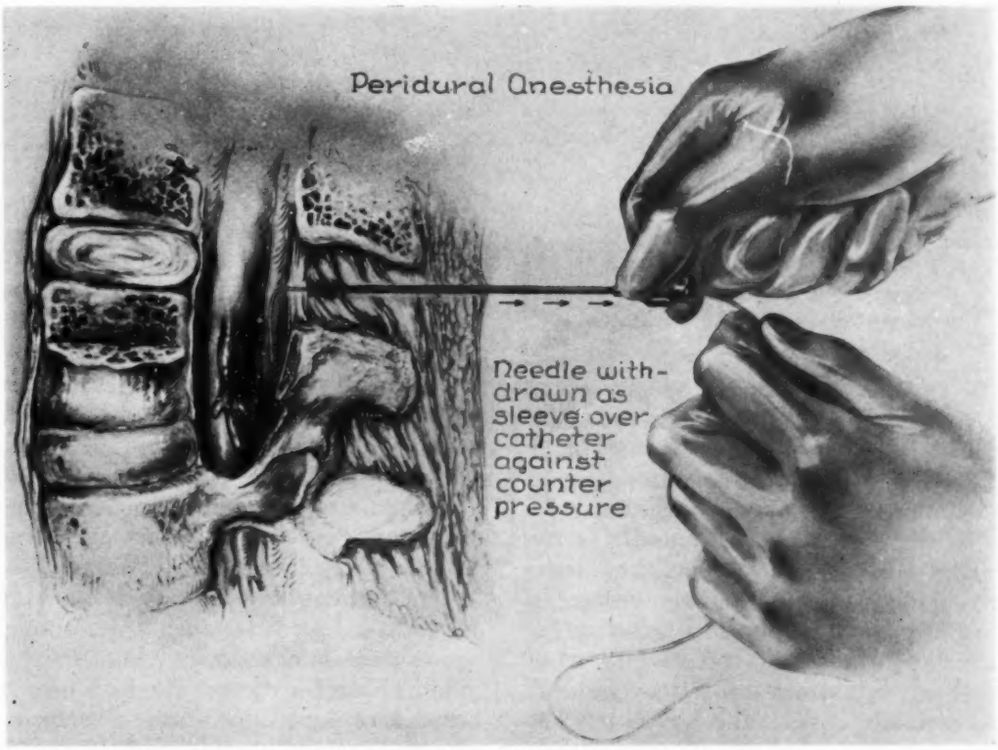

FIG. 1. The catheter can be passed in either direction and remains extradural.

Technic. The technic of extradural anal-

FIG. 2. Partial compression of the tenth thoracic vertebra and marked compression of the eleventh vertebra. The pantopaque is shown at the level of the eleventh thoracic vertebra.

gesia involves the introduction and placement of a catheter into the extradural space. This space consists of that portion of the spinal canal between the dura and the endosteum of the spinal column, extending from the foramen magnum to the sacral hiatus, bounded anteriorly by the posterior longitudinal ligament, posteriorly by the laminas of all the vertebrae and the ligamentum flavum and laterally by the pedicles and the intervertebral foramens, through which extensions of the extradural space pass laterally outside the bony canal. A Huber pointed Touhy needle is placed into this space by piercing the ligamentum flavum. This is usually done at the second lumbar level where the extradural space is widest. A catheter is then passed through the needle, which can be directed either cephalad or caudad depending on the location desired. The needle is removed, and the anesthetic solution injected through the catheter. (Fig. 1.) Because the lateral extensions of the extradural space allow the solution to leak through the intervertebral foramens in varying amounts, the extent and degree of analgesia are related inversely, one to the other. Thus, if a large volume of local anesthetic passes freely through the intervertebral foramens, a limited area of analgesia will result, but will be of high quality. However, if a large volume of local anesthetic solution does not pass freely through the intervertebral foramens, a wide area of anesthesia will result, but will be of poor quality and spotty in nature, requiring serial injections to produce correct intensity.[10]

Gravity, the site of placement of the catheter and the strength and volume of the fluid injected are other factors influencing the extent and degree of analgesia obtained by this method which can be of any given magnitude, from a localized band of analgesia of one or two nerve segments to complete analgesia of almost the entire body.

Uses. Extradural analgesia has a wide range of usefulness. It has been successfully employed not only in obstetric procedures, but also in surgical procedures involving the chest, the upper and lower abdomen and the lower extremities. It has been advocated for large numbers of military casualties to alleviate pain and as a method of handling casualities for transportation to rear areas for definitive treatment.[11] It is also quite useful as a therapeutic and diagnostic measure.

Due to the fact that segmental analgesia can be obtained, extradural analgesia has the advantage over spinal or general anesthesia in that the patient is able to cooperate in the operative procedure being performed. The following case report is an example at hand.

CASE REPORT

The patient was admitted on March 17, 1953, at 11:35 A.M. with the complaints of acute pain in his lower thoracic spine and difficulty in breathing. He had been digging beneath a sidewalk when a cement block weighing approximately 600 pounds fell on him and flexed his back acutely. After a short delay the block was lifted and he was transported to the hospital in the prone position by the police ambulance. He had been in the Navy and had had no serious illnesses or injuries.

On physical examination the patient was holding himself in the prone position and there was an obvious severe kyphos of the lower dorsal spine. Blood pressure was 120/70, pulse 100 and respiration 40 and shallow. There was an abrasion of the right shoulder, but no other evidence of trauma or injury to the spinal cord. Because of his severe discomfort and inability to cooperate, only a cursory examination could be carried out.

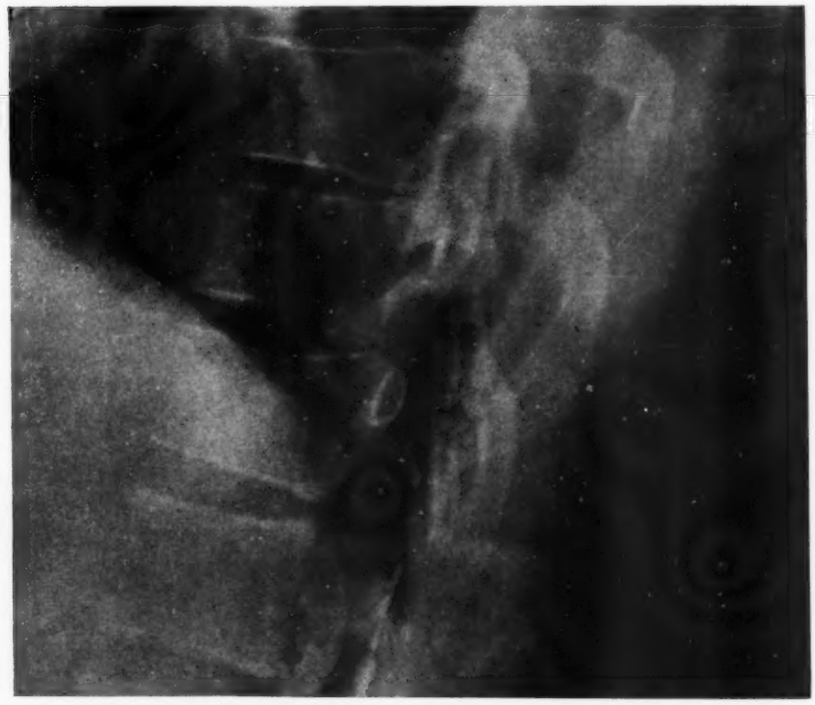

FIG. 3. The compression of the vertebral bodies is corrected.

Blood count revealed the following: hemoglobin 14.6 gm.; red blood cells, 4.9 million; white blood cells, 9,800; polymorphonuclears, 62; lymphocytes, 33; monocytes, 3; eosinophils, 1; basophils, 1. Urinalysis: specific gravity 1.011, neutral pH, negative for albumin and sugar, with occasional red and white blood cells.

Oxygen by mask was begun and 75 mg. of demerol® were given intramuscularly. Eight cubic centimeters of 1 per cent xylocaine were infiltrated into the fascia and muscles in the region of the kyphos. This gave no relief and the patient would not tolerate the oxygen mask.

An extradural block was selected as the method of management. A special Touhy needle was inserted with local infiltration at L-1-2 interspace and a catheter was passed cephalad so that the tip was thought to be opposite D-11. Five cubic centimeters of 1 per cent xylocaine were injected and some bloody fluid was aspirated. Pantopaque,® 1 cc., was injected through the catheter and portable x-rays were taken. They revealed compression fractures of D-10 and 11 and the pantopaque was visible at this level. (Fig. 2.) Within ten minutes the patient experienced marked relief and was breathing deeply. He was cooperative and retained partial motor power in his lower extremities, but there was loss of sensation. Belt anesthesia from D-9–11 was obtained for the procedure. He was then taken to the operating room and actively participated as he was gently extended between two tables in the prone position. The fractures reduced without pain or difficulty. (Fig. 3.) Portable x-ray confirmed this and a hyperextension jacket was applied with the epidural catheter remaining in place. Sterile vaseline gauze was wrapped about the catheter as it emerged from the skin so the plaster would not adhere to it. Repeat xylocaine instillations were given at 4:30 P.M. and 8:30 P.M. on the day of admission and 6 cc. at 8:30 A.M. the following day. The catheter was withdrawn twenty-four hours after insertion. The patient had very little discomfort, but due to his apprehension 50 mg. of demerol hydrochloride were administered at 1:45 A.M. and 5:45 A.M. the first night and at bedtime of his second hospital day.

He was able to void the evening of admission and never required catheterization. He never had distention but did complain of "gas pains" the first two days. He began progressive ambulation the third day, passed flatus and had a good appetite the fourth day. Codeine phosphate 0/064 was given at bedtime the third day, but he had no further analgesics at any time.

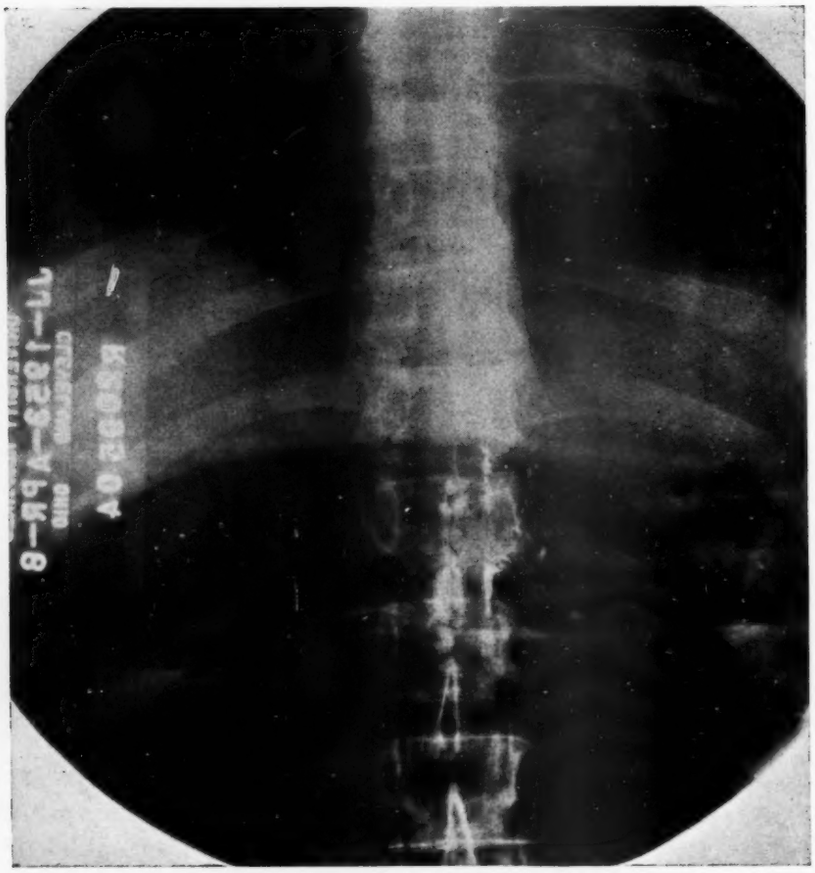

FIG. 4. The pantopaque is coursing along the nerves and in the extradural space.

On the seventh hospital day x-rays showed pantopaque along the eleventh and twelfth nerves and the fractures remained reduced. (Fig. 4.) On the twelfth day the patient was discharged ambulatory.

COMMENTS

Continuous extradural analgesia by the lumbar approach is an excellent method of controlling pain from severe compression injuries, but it must be carried out by one who is thoroughly familiar with the technic. It is contraindicated in the presence of a fracture dislocation or compression of the spinal cord, as an opening in the dura can be associated with these.

Extradural analgesia causes hyperperistalsis and is beneficial in preventing the reflex ileus which so often accompanies trauma to the back.

This technic has been used with success on similar cases on two previous occasions by Hingson.

The analgesia can be maintained for as long as necessary for the individual case.

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Avulsion of the Distal Biceps Brachii Tendon

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AVULSION of the biceps brachii tendon from its radial insertion is rare. In 1941 Dobbie offered a comprehensive review of the subject, analyzing seventy-five cases.[1] Since Dobbie's paper twenty additional cases have been reported.[2,3]

1A 1B

FIG. 1A and B. Biceps (left) is retracted upward, presenting flat appearance in distal third of arm.

Avulsion of the distal biceps tendon usually results from a sudden extension of a previously flexed elbow, such as lifting a heavy load. The patient experiences a "snapping sensation," followed by soreness and weakness in the elbow. Flexion weakness is especially marked. Inspection reveals flatness of the arm above the crease of the elbow and a large ovoid mass high up in the arm, representing the "unleashed" or "bunched-up" contracted biceps brachii muscle.

It is universally agreed that operative repair is essential for restoration of muscle function. However, opinion differs as to the type of repair, the dispute revolving around the choice of site for reinsertion of the avulsed tendon. Since the biceps is not essential for forearm supination, the original anatomic point of attachment on the radial tubercle is not desirable: visualization of the radial tubercle, requiring as it does dissection among important structures in the antecubital space, proves both time-consuming and hazardous. The essential function of the biceps brachii muscle is flexion of the elbow, and this may be restored by the selection of a site more readily accessible than the radial tubercle for reinsertion of an avulsed biceps tendon. Kirschner utilizes the anterior surface of the radius,[4] but forearm flexion is perhaps best and most easily obtained not by radial attachment, but rather by way of the brachialis, after the method of Gimbal and Genteir.[5] By suturing the torn biceps tendon to the tendinous portion of the brachialis, contraction force of the former muscle is transmitted to the ulna, which, in turn, affects forearm flexion as efficaciously as radial traction. The detailed method of repair is embodied in the following case report.

CASE REPORT

F. M., a fifty-five year old white man, was admitted to the Albert Einstein Medical Center on November 5, 1952, with a history of having experienced a tearing sensation in the distal third of his left arm anteriorly while lifting a heavy load at work on October 25, 1952. Immediately he noticed a swelling in the upper third of the arm, and soreness and weakness in the lower third.

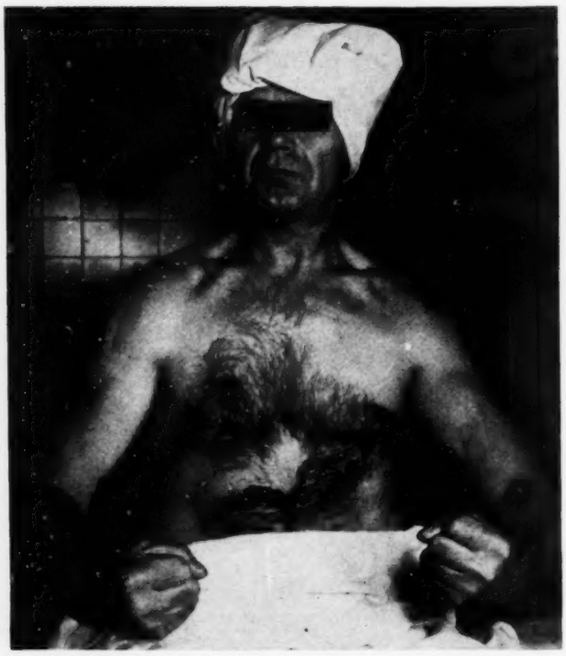

FIG. 1C. Demonstration of forearm flexion.

Physical examination was negative except for local alterations. The biceps was retracted upward and appeared as a round mass high in the arm. The distal third of the arm presented a flat appearance. (Fig. 1.) Flexion of the forearm was markedly reduced, both in force and extent.

Operative repair was carried out November 7, 1952, thirteen days following injury. An anterolateral incision was made over the elbow. The ulnar nerve was exposed and retracted medially. Following incision of the fascia, about 20 cc. of serosanguineous fluid escaped. Retraction of the fascia permitted visualization of the avulsed biceps tendon, a biopsy of which was taken. (Fig. 2.)

Following exposure of the biceps, its avulsed tendon was split longitudinally for a distance of approximately 4 inches, thereby creating two free ends. (Fig. 3.) An opening was then made in the tendinous portion of the brachialis muscle (Fig. 4); the next and important step involved wrapping the "two ends" of the biceps tendon around the brachialis and bringing them out through the previously established opening in the latter muscle. (Fig. 5.) Fixation was accomplished by suturing the two tendinous free ends of the biceps muscle to each other and to the brachialis (Fig. 6.); No. 0 silk suture was used. The fascia and skin were closed with interrupted suture, and the elbow

Fig. 2. Avulsed biceps tendon is visualized.

immobilized in acute flexion by a plaster of paris splint for three weeks. Following removal of the splint active exercises were instituted, and at the end of six weeks full flexion was restored to the left forearm; the initial deformity of the arm was gone. At the time of this writing, sixteen months following surgery, the patient enjoys full function of his left forearm.

Microscopic examination of the muscle tissue taken for biopsy showed "focal hemorrhage, necrosis and granulation tissue."

SUMMARY AND CONCLUSIONS

Avulsion of the biceps brachii tendon from its attachment to the radial tubercle is a rare condition. Including the present report, only ninety-six cases appear in the literature.

Diagnosis is not difficult. Essential features include a history of sudden extension of a previously flexed elbow, with a "snapping sensation," soreness and weakness, proximal bulging with distal flatness of the arm and inability to flex the elbow completely.

Treatment is surgical. The method of choice involves attachment of the severed tendon not to the radius but rather indirectly to the ulna, by way of the brachialis. This is accomplished by splitting the biceps tendon longitudinally, thereby creating two tails, enveloping the brachialis muscle with these tails and finally bringing them through an opening made in the brachialis; the "two ends" of the biceps are then sutured to each other and the brachialis. The repair thus effected is firm and binding and results in excellent restoration of flexion function. This method is simpler and safer than anatomic restoration and is equal, if not

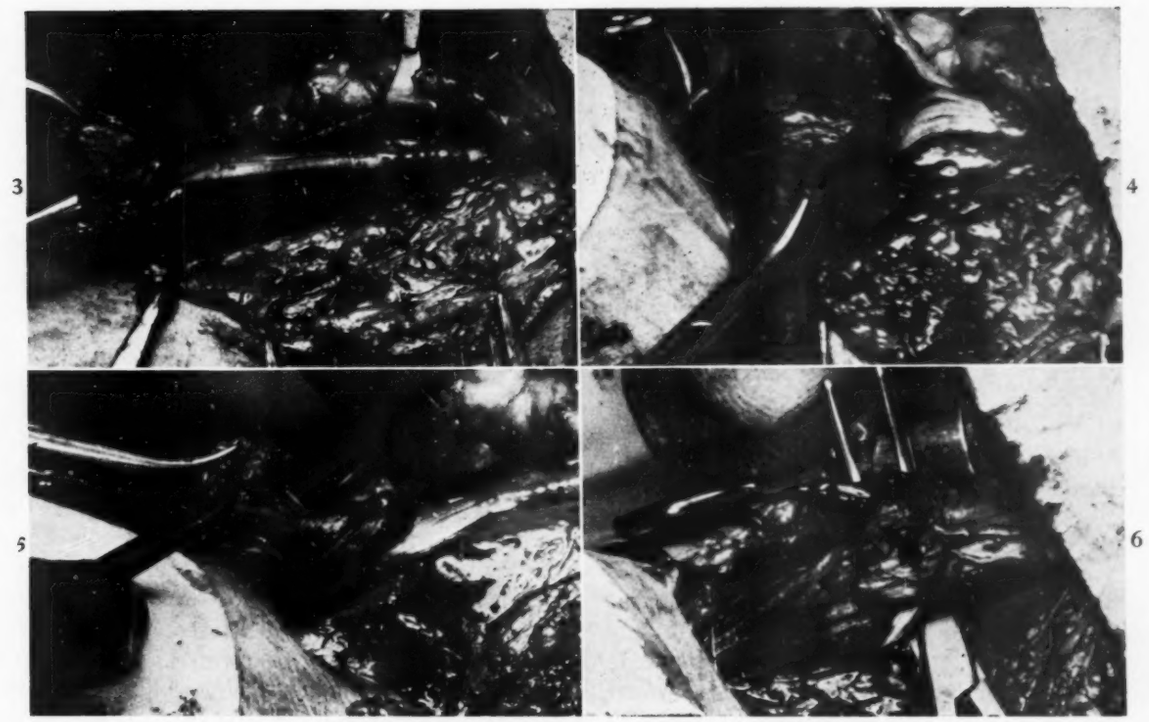

FIG. 3. Dissection of avulsed tendon and beginning of longitudinal split.

FIG. 4. "Two ends" of biceps tendon; opening created in brachialis muscle.

FIG. 5. Ends of biceps wrapped around brachialis and brought through opening in latter.

FIG. 6. Ends of biceps sutured to each other and to brachialis.

superior, to the latter in terms of functional results.

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Congenital Atresia of the Common Bile Duct

SURGICAL CURE IN THREE OF FOUR CASES

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OBSTRUCTIVE jaundice appearing in the neonatal period, with acholic stools and progressive persistent clinical evidence of biliary obstruction, is familiar to the pediatrician and surgeon and has been diagnosed as congenital atresia of the bile ducts. Holmes[1] in 1916 estimated that 16 per cent of the cases should be amenable to surgical therapy, but it was not until 1927 that Ladd[2] first had a successful case and eleven additional subsequent ones.[3] Rosemond et al.[4] in 1949 reviewed twenty-one cases available from the literature and one personal case. Further search of the literature reveals nine additional cases in which operation appears to have been successful.[5–8] It would seem that although the condition is not uncommon, results of surgery are discouraging and success is met only in isolated instances. It is because of our unique experience in surgically relieving this condition in three of four successive infants encountered in a one-year period that we believe this report is justified.

CASE REPORTS

CASE I. A nine week old white male infant was admitted to the hospital on September 19, 1949, because of progressive jaundice first seen at two weeks of age. The mother had noticed his urine had stained the diapers markedly since birth. Yellowing of the skin and sclerae had gradually become more intense. The number of stools had also gradually increased in number to five daily and were light colored and of a mushy consistency. The infant was the result of the first and normal pregnancy and the neonatal period was otherwise uneventful. On physical examination his skin and sclerae were moderately jaundiced and the liver was palpable at the costal margin. Otherwise he was normal except for bilateral syndactylism of the second and third toes. His hemogram was normal, the icteric index 50 units and serum bilirubin 8 mg. per cent (6 mg. per cent direct). The stools and urine were repeatedly negative for urobilinogen but the urine was positive for bile. There was no laboratory evidence of hemolytic disease. Upon abdominal exploration on September 28th the gallbladder and hepatic ducts appeared to be intact but a distal common duct could not be identified. A cholecystoduodenostomy was performed. The infant withstood the procedure well and his immediate postoperative course appeared normal. The sutures were removed on the seventh postoperative day. On the ninth postoperative day the wound was found dehisced through to the peritoneum. Following immediate repair the wound healed and the subsequent hospital course was normal. Four days after operation a normal amount of urobilinogen was present in the stools. There was a rapid and steady decrease in the serum bilirubin, and on a full diet the patient's stools were of normal character. Up to four years of age his growth and development proceeded normally and without evidence of hepatic disease. (Fig. 1.)

CASE II. An eight week old male infant was admitted on December 10, 1949, with persistent jaundice. He was jaundiced at birth. The condition seemed to clear up in ten days but the infant became jaundiced again with increasing intensity. The birth and family history were normal and the mother had not been otherwise concerned about the infant. Except for moderate jaundice of skin and sclerae and a liver palpable 3 cm. below the right costal margin, physical examination revealed a normal-appearing infant. Laboratory studies to rule out hemolytic disease, sepsis and syphilis were normal. Repeated stools and urine were negative for urobilinogen. The icteric index was 40 units. Magnesium sulfate was introduced into the duodenum in

an attempt to release a possible inspissated plug; however, no urobilinogen appeared in the stools or urine following this procedure. Upon exploration on December 22nd the gallbladder and common duct were found to be distended. The common duct was aspirated of a clear yellow bile and 4 cc. of normal saline were injected under slight pressure, but none could be forced into the duodenum. An anastomosis of the gallbladder to the first part of the duodenum was performed. The postoperative course was uncomplicated. Within six days urobilinogen was demonstrated in his urine and stools. One week after surgery the icteric index was 14 units with serum bilirubin 1.7 mg. per cent (1.2 mg. direct). He was discharged on January 7, 1950, and the follow-up observation on July 12, 1953, at three and a half years of age, showed him to be a normal-appearing boy without evidence of biliary tract disease.

Case III. An eight week old white male infant was admitted on April 10, 1950, because of progressive jaundice. The mother's pregnancy and delivery were reported to be normal although the infant weighed only 4 pounds, 12 ounces at birth. He did well as a newborn and was gaining weight when discharged from the nursery. It was noted, however, that he was slightly icteric, which was thought to be icterus neonatorum. The mother was Rh negative and the father Rh positive. There had been one previous pregnancy resulting in an abortion at three and a half months. The mother had no antibody titer and the infant was Rh negative. The Coombs test was negative at birth. Although he did well otherwise, his icterus increased at home and it was quite evident at the time of the admission physical examination. The liver was 1 cm. below the costal margin. There were no other abnormal findings. Laboratory findings evidenced moderate anemia, an icteric index of 35 units and a serum bilirubin of 7.2 mg. per cent. Twenty-four-hour stool and urine examinations repeatedly contained no urobilinogen. Cream was instilled into the duodenum on several occasions but no urobilinogen could be detected in the stools following these procedures. Upon abdominal exploration on April 27th the gallbladder and upper biliary tract were intact. The distal common bile duct could not be demonstrated. A cholecystoduodenostomy was performed and the postoperative course was uncomplicated. It was only after three weeks, however, that normal amounts of urobilinogen could be demonstrated in the stool. The patient progressed normally at home and without return of jaundice up to the age of three years. His liver function tests, including liver biopsy, were normal five months after surgery.

Fig. 1. Patient at three years, three months of age.

Case IV. The fourth patient seen during this period, a five month old white female, had a rudimentary gallbladder, cystic and common duct, but no hepatic ducts could be demonstrated and no bile was in the system at the time of exploration. No bile laking in this area could be found by needle probing of the liver and the situation was considered inoperable. The child had the usual course of one unrelieved of biliary tract obstruction and survived to the age of nineteen months.

COMMENTS

These cases are not presented as exercises in differential diagnosis, unusual pre- or postoperative care, or for the surgical technic used, but only to re-emphasize the possible reward of abdominal exploration in infants with evidence of persistent complete biliary tract

obstruction in the first few months of life. No false statistical conclusions should be drawn from this small number of patients encountered in such a short period of time, because from prior and subsequent experience it is well known that this is an unusual group for one surgeon to encounter.

SUMMARY

Four infants with histories and laboratory findings of complete biliary tract obstruction observed during a one-year period were explored surgically. Cholecystoduodenostomy gave relief to three of the infants. The fourth infant had no extrahepatic ducts and was considered inoperable. Growth and development were normal in the three relieved infants up to three years of age and the fourth infant died at nineteenth months of age.

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Modified Heller Operation for Achalasia

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THE clinical syndrome characterized by dilation and hypertrophy of the esophagus associated with non-organic obstruction of the cardia has numerous names as well as treatments, none of which have been entirely satisfactory. Terms such as cardiospasm, idiopathic dilation of the esophagus, megaesophagus, phrenospasm, etc., reflect the different theories as to the cause of this condition. Ochsner and DeBakey[1] in their detailed review of the literature cite many of the theories. Probably the condition is due to the absence or abnormality of Auerbach's plexus of nerve cells in the esophageal wall, being analogous to megacolon, hypertrophic pyloric stenosis,[9] and similar conditions of the sphincter of Oddi (postcholecystectomy syndrome and chronic relapsing pancreatitis) and ureterovesical area (megaureter). It has been recommended[11] that all of these conditions can be attacked by a similar operation, i.e., longitudinal incision through all the layers of the wall except the mucosa, or sphincterotomy, a similar procedure.

Treatment of achalasia should be by conservative means if possible. No attempt will be made to discuss these methods. If the condition does not respond to conservative means, more radical treatment is indicated.

Probably the two most frequently performed operations are: (1) Sweet's operation[5,8] which is essentially a longitudinal incision through the constricted area which is sutured transversely, thus widening the cardia, and (2) esophagogastrostomy, a side-to-side anastomosis of the esophagus to the lower end of the fundus of the stomach as recommended by Ochsner and DeBakey. Both of these operations are effective in relieving the obstruction. However, both involve a fairly extensive suture line, half of which is in the esophagus. This requires time and is not without danger because of the relatively poor healing of esophageal anastomoses. Also, many of these patients, while cured of their obstruction, have symptoms of esophagitis due to reflux of gastric juice into the lower end of the esophagus through the abnormally wide opening of the Sweet operation or from the fact that the esophagus is literally a part of the wall of the stomach in the esophagogastrostomy. Barnes and McElwee[10] describe a resection of the lower esophagus and upper stomach with esophagojejunostomy in Roux-Y fashion. This is believed to prevent esophagitis but is a formidable procedure. Wangensteen's operation[9] of resection of the lower esophagus and acid-bearing part of the stomach plus pylorotomy prevents the esophagitis but is also a formidable procedure.

Heller[2] in 1913 reported an extramucous cardiomyotomy which had been proposed by Gottstein[3] in 1901. This consisted of anterior and posterior incisions through all layers of the lower esophagus and cardia except the mucosa which was allowed to bulge out through the incisions. The procedure was done through an abdominal approach. This is an operation similar to the Ramstedt procedure for hypertrophic pyloric stenosis. Later Zaaijer[4] stated that one anterior incision was sufficient. Graham[6,7] in recommending the Heller operation states that unsatisfactory results from that procedure are probably due to an inadequate incision. The incision should be 5 inches in length, 3 inches of which are in the lower end of the esophagus and 2 inches in the stomach through all coats except the mucosa. The Heller procedure is probably the most physiologic because no abnormal opening is made. The constricting fibrous and muscular elements are cut allowing the normal opening to dilate as needed. In addition the Heller operation is relatively simple and no suturing is required. The main difficulties with the Heller procedure are: (1) making an adequate incision, and (2) the ease with which the mucosa is inadvertently entered. An adequate incision in the esophagus can be made only through a thoracic approach.

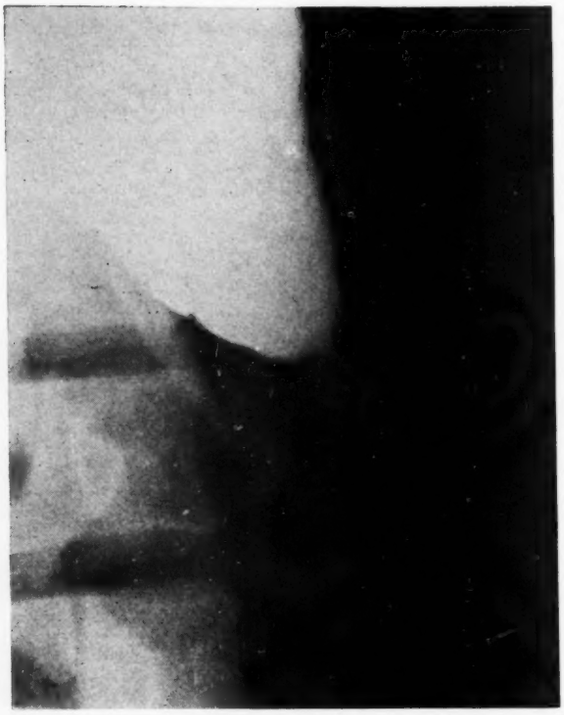

FIG. 1. Preoperative film showing magnified view of lower esophageal segment.

In order to facilitate making the esophageal and stomach incision without jeopardizing the integrity of the esophageal mucosa, an opening may be made in the anterior stomach wall at the lower end of the proposed longitudinal incision.[9] This opening is big enough to insert the forefinger which can be inserted into the cardia and used as a guide in making the longitudinal incision. Also when the longitudinal incision is completed, the lumen of the cardia can be easily palpated for any remaining circular bands and the lumen demonstrated to be adequate. The opening in the stomach wall is then closed with interrupted Lembert's sutures. Care should be taken to avoid injury to either vagus nerve because this may interfere with motility of the stomach.

CASE REPORT

A twenty-one year old Negro soldier was admitted to the Fort Belvoir Army Hospital on January 15, 1953, with the chief complaint of vomiting for nineteen months. Approximately in March, 1951, he noted that food would "go down to the pit of my stomach and then turn sour." He was sent to Korea in July, 1951, when he first started to vomit occasionally after meals. This persisted although he remained on duty in Korea until July, 1952, when he was returned to the United States. Vomiting gradually became worse until on admission he was vomiting after every meal. His weight had dropped from a normal of 150 pounds to 125. A chest film showed a smooth, curving paraspinal shadow just to the right of the heart. Barium swallow showed this to be a strikingly dilated esophagus. (Fig. 1.) Radiologic report was as follows: "At fluoroscopic examination, the initial swallow of barium dropped slowly down the esophagus through a mixture of fluid and food particles. Further ingestion outlined a strikingly dilated esophagus, with the dilatation beginning from just above the level of the aortic arch to the diaphragmatic portion of the esophagus where it tapered abruptly into a narrow, beak-like segment near its junction with the cardia of the stomach. Normal peristalsis was replaced by abnormal secondary and tertiary contractions, giving the lower end of the esophagus a somewhat serrated appearance. Inspiratory and expiratory attempts to milk the barium mixture through the narrowed segment were largely unsuccessful. Inhalation of amyl nitrite produced no appreciable relaxation. During the entire examination only a very small trickle of barium was observed to gain entrance to the stomach." A diagnosis of cardiospasm was made and the patient was put on conservative treatment. He continued to vomit and by February 7, 1953, weighed 122 pounds. He was transferred to the Surgical Service where on February 9, 1953, he was operated upon.

At operation the left thorax was entered through the bed of the resected eighth rib. The lower esophagus was mobilized after cutting the pulmonary ligament. The diaphragm was opened from the tendinous portion to the esophageal hiatus. The left lobe of the liver was mobilized and the spleen retracted, exposing the fundus of the stomach. The lowest 1 cm. of the esophagus was constricted to a diameter of less than 1 cm. This constriction extended proximally for about 3 cm. to a lesser degree. Above this the esophagus was extremely thick-walled and although empty was of tremendous diameter. An anterior incision was made through all layers of the wall of the esophagus except the mucosa over the lower 3 inches of the esophagus and extending 2 inches into the fundus of the stomach. At the

lower end of this incision in the stomach the mucosa was entered. A finger was inserted through this opening and pushed gently into the esophagus. This allowed an estimation of the diameter of the lower end of the esophagus and enabled the detection of two or three small fibrous bands which were not yet cut. This opening in the stomach was then sutured with interrupted cotton. The diaphragm was repaired with interrupted mattress sutures of No. 0 cotton. Two large angular drains were inserted between the ninth and tenth ribs laterally and between the fourth and fifth ribs anteriorly. The chest wall was closed in layers with interrupted cotton. The drainage tubes were connected to a water-seal bottle. Postoperatively the lung showed complete expansion on the second postoperative day and the tubes were removed. Wangensteen suction through a Levin tube in the stomach was carried on for two days until peristalsis was adequate. The patient was then started on a bland diet which was quickly increased to a regular diet. All food was retained. There was no vomiting or feeling of fullness in the chest. A barium swallow on February 27, 1953, was reported as follows: "There was no evidence of any retained fluid or food particles in the esophagus at the onset of roentgenoscopic examination. In the upright position, individual swallows of the barium mixture passed readily through the esophagus and into the stomach with little or no delay at the hiatus. With the patient in the Trendelenburg position, *only* on straining was there regurgitation of the stomach contents into the esophagus. Dilatation of the esophagus was again noted but not demonstrated to the striking degree observed prior to surgery. There was some narrowing and irregularity of the diaphragmatic portion of the esophagus; however, this segment displayed good distensibility, presenting a fairly wide and efficient hiatus." (Fig. 2.)

The patient was sent on convalescent leave on February 28th weighing 135 pounds, a gain of 13 pounds in the nineteen days since his operation. He returned from leave on March 31st, at which time a barium swallow showed essentially the same picture. He was symptom-free, eating a normal diet and had no symptoms either of obstruction or of esophagitis. He weighed 147 pounds, which was within 3 pounds of his normal weight. He was returned to full duty. After one year the patient weighed 160 pounds. He was entirely symptom-free and was performing full military duty. There were no symptoms of esophagitis.

FIG. 2. Postoperative film showing decreased diameter of esophagus after normal swallowing of barium. There is a distensible and efficient hiatus, the caliber of which prevents excessive regurgitation.

SUMMARY

A case of severe achalasia is presented which was treated by the modified Heller operation. This resulted in complete alleviation of obstructive symptoms. To date no symptoms of esophagitis have appeared. It is thought that the Heller procedure results in a more physiologic cardia than other operations, and is more in line with similar operations for similar conditions at other sites. The resulting cardia is expansible and adequate both in passage of the bolus and in preventing regurgitation.

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H. HUBER studied the therapeutic results of almost 3,500 patients treated in the Women's Clinic at the University of Kiel, Germany. Cancer of the vulva responded better to surgery than to radiotherapy, but patients with cancer of the vagina lived longer after radiotherapy. It was interesting to note that patients with cervical cancer in stages 1, 2 or 3 did better after radiotherapy than after surgery. These results are at variance with those of many gynecologists who believe that surgery gives preferable results in the early cases. If other clinics report similar findings as Huber, radiotherapy will eventually become the therapy of choice in cervical cancer. (*Richard A. Leonardo, M.D.*)

Pinch-grafted Skin Used to Replace Missing Tendons

GEORGE MIYAKAWA, M.D., *Diplomate, American Board of Orthopedic Surgery, Charleston, West Virginia*

CUTIS or skin with epidermis removed has been used in place of fascia lata, kangaroo tendons, wires and other materials with great strength.[1] Numerous cases have now been studied several years after surgery. There has not been a case of epidermoid cyst or other skin disorder reported. This may be due to the fact that the cutis usually becomes necrotic and is replaced by fibrous tissue. Under certain circumstances grafted skin can be used to replace tendons.

CASE REPORT

In August, 1945, L. C., a four year old boy, was admitted to the Charleston General Hospital with a history that his right forearm had been caught in an electric clothes wringer. The general physical examination was not remarkable. The patient's temperature, pulse and respiration were normal. The right forearm showed marked swelling on the flexor surface. On the ulnar side of the mid-forearm there was an area measuring about 2 by 3 inches where

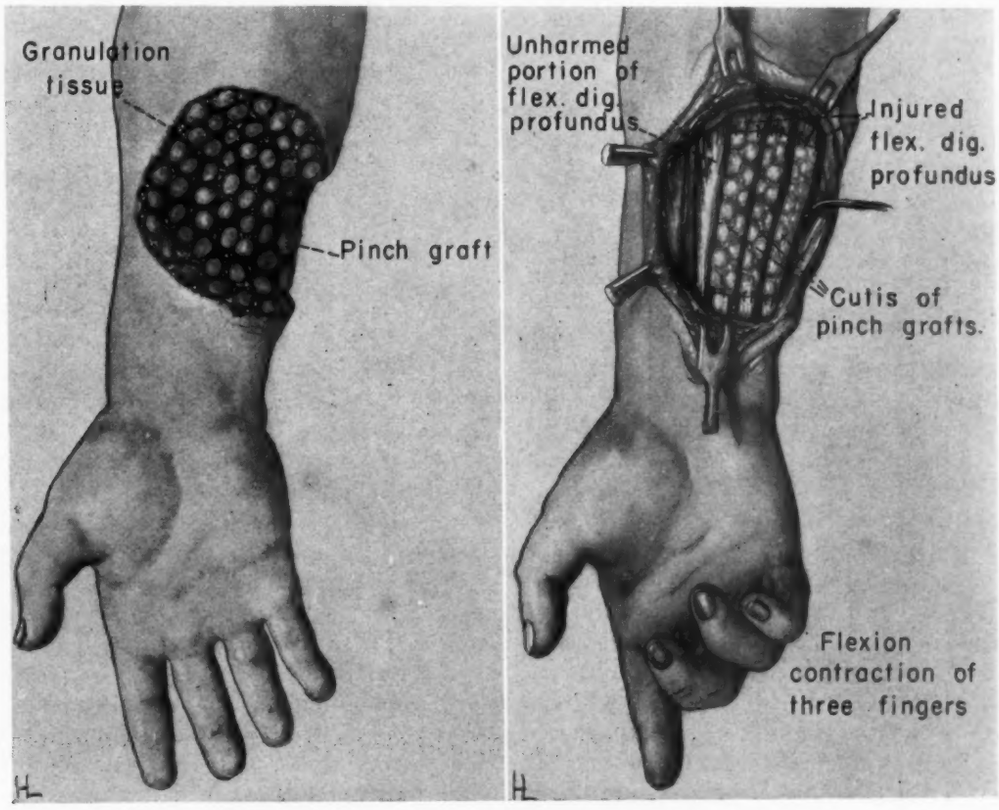

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FIG. 1. The denuded area has been pinch-grafted.

FIG. 2. The cutis of pinch graft has been cut into strips.

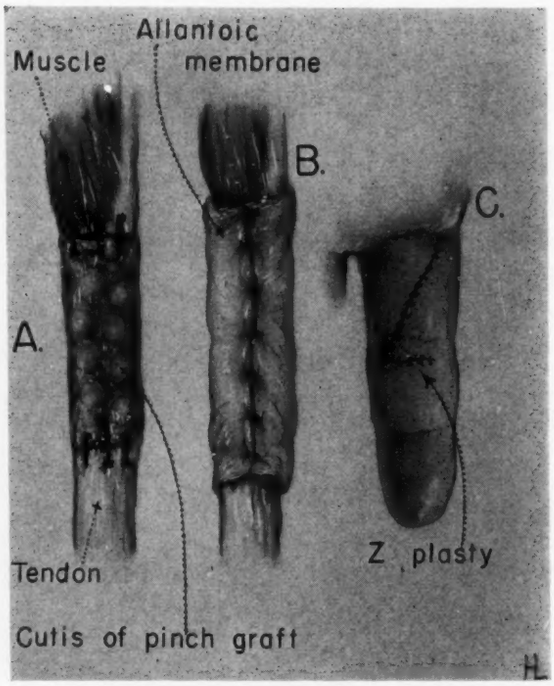

FIG. 3. A, close-up of maintaining continuity between muscle and tendon; B, the cutis has been wrapped with allantoic membrane; C, z-plasty for the repair of flexion-contracture of the finger.

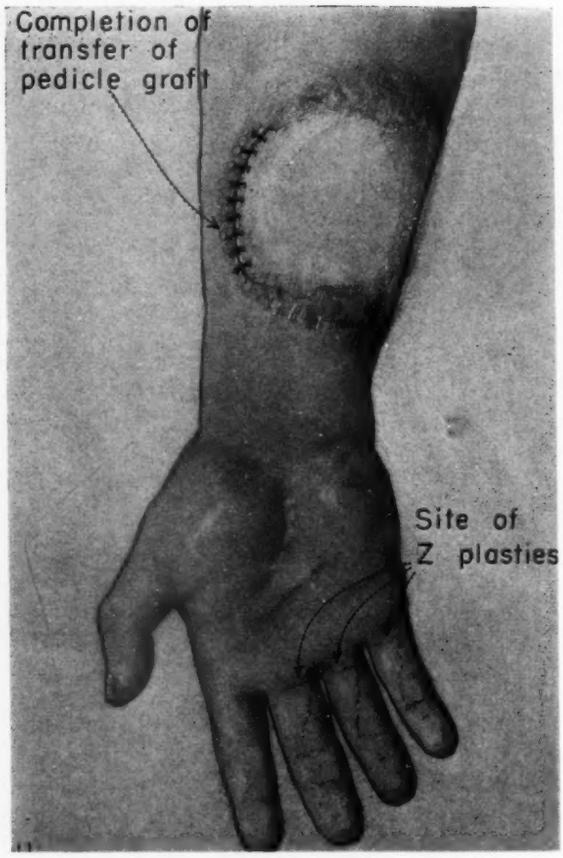

FIG. 4. Completion of transfer of the pedicle skin graft.

the skin was reddish in color due to friction. The patient was able to move the thumb and index finger. He was unable to flex the middle, ring or small fingers actively. Any attempt to extend these fingers caused severe pain. Radial pulsations were present. There was complete loss of the ulnar nerve sensation.

The friction area developed an eschar which was soon removed. The necrosis gradually extended into the flexor carpi ulnaris, flexor digitorum sublimis and profundus to the three ulnar fingers, as well as the ulnar nerve and the ulnar artery in the region of the musculotendinous juncture. After clean granulation tissue developed, this area was pinch-grafted and the child was discharged from the hospital. (Fig. 1.)

On readmission two and a half months later the pinch-grafted area was well healed and there were flexion contractures of the middle, ring and small fingers. Passive extension of these fingers caused pulling in the grafted area which now measured about 2 inches in diameter. There was an absence of sensation in the region of the ulnar nerve distribution. On subsequent visits flexion contractures of the middle, ring and small fingers were treated by elastic traction attached to a banjo. Traction was obtained by the use of cellulose acetate (ordinary x-ray film) dissolved in acetone. Only partial correction was obtained.

On December 27, 1945, the following surgical procedure was carried out under general anesthesia. The epidermis of the pinch-grafted area was carefully removed by scraping this area with a scalpel held at right angle to the surface. A circular incision was made along the perimeter of this area permitting the margin to be elevated. The forearm was then further opened exposing the flexor muscles proximally and flexor tendons distally. The flexor sublimis muscles and tendons were more extensively necrosed then the profundus group.

The grafted area was then cut into strips, maintaining proximal attachments to profundus muscles and distal attachments to the profundus tendons. (Fig. 2.) These strips were then carefully wrapped with allantoic membrane. An abdominal skin pedicle was then elevated and the free margin was sutured over the grafted skin strips onto the margins of the

FIG. 5. Six years following the operative procedure there is complete range of motion and no evidence of dermal complications.

skin of the forearm. Z-plasties were performed upon the contracted skin on the flexor surface of the middle, ring and small fingers. (Fig. 3.) After six weeks of immobilization the pedicle had firmly united to the forearm, so it was then detached from the abdomen. (Fig. 4.)

Passive and active exercises were begun as soon as possible after the pedicle had firmly united. Approximately six months later secondary end-to-end suture of the ulnar nerve was carried out through an incision extending from above the elbow to the region of the right pisiform bone. The branches of the ulnar nerve to the flexor digitorum profundus muscles were carefully separated proximally and saved. A plaster cast was then applied with the wrist and elbow in flexion. After six weeks the elbow and wrist were gradually straightened. Immobilization was discontinued after about two months and intensive active and passive exercises were begun.

Eight months following the nerve suture there was evidence of beginning return of the ulnar nerve function. However, the atrophy of the intrinsic muscles of the hand was still quite apparent.

This patient has been observed from time to time and he has shown progressive improvement in the forearm function. When last observed in September, 1953, seven years since the pinch-grafted skin was buried under pedicle skin graft, there was complete return of function with no evidence of any dermal complications. (Fig. 5.) With growth the pedicle graft has become somewhat elongated.

SUMMARY

1. This case is presented to show that grafted skin may be used *in situ* to replace missing tendons.

2. It is not possible to estimate upon original examination the depth of necrosis in friction injuries.

3. There has been no evidence of dermal complications seven years following the use of pinch-grafted skin denuded of epidermis to replace tendons.

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A Case of Severed Ureter Successfully Implanted into Bladder after Four Years

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From the Raymond Hospital and Clinic, Johnstown, Pennsylvania.

IT is our purpose to prove that the condition of severed ureter can be corrected without implanting the ureter in the colon or performing a nephrectomy. Also, the bladder does not become hopelessly contracted in the absence of infection and persistence may bring success after many failures.

CASE REPORT

A thirty-nine year old woman, para v, underwent total hysterectomy on May 11, 1948. The left ureter was unknowingly severed about 1 inch from the bladder.

A pyelogram in August revealed considerable hydronephrosis with dilated ureter on the left side due to postoperative damming back of urine. The ureter was found to end 1 inch from the bladder.

An attempt was made at vaginal repair using steel sutures but it failed to hold; also a lower abdominal approach was used but without success. In October the ureter was exposed by a flank incision; the proximal end was dissected and an attempt was made to implant it into the bladder. Unfortunately a catheter had not been left in the bladder to aid in identification, dependence being placed on the instillation of a solution of dye. While the bladder was being sought, the patients' condition became alarming. A puncture was made into what was thought to be bladder tissue; dye solution escaped and the ureter was quickly sutured in. A check pyelogram reported we had been successful, but clinically, due to the increase of drainage *per vaginam*, we concluded implantation had been made into the vaginal fornix. Thus a ureterovesicovaginal fistula was created, incidentally relieving back pressure on the ureter and kidney. The ureter was found markedly dilated at operation and the kidney was moderately enlarged.

On December 8th the Charles Mayo technic was tried.[1] The vaginal opening, including the end of the ureter, was freed by a circular incision after passing a small catheter via the cystoscope and fishing out the end through the bladder opening. The ends of the purse-string suture were left long, carried through the eye end of the catheter, and the latter was withdrawn from the urethra. The suture was threaded and passed through a labium majus and tied. The cuff of tissue which was thus inverted into the bladder was reinforced with another purse-string suture and the mucosa was sutured. Unfortunately the patient pulled out the labial suture and the repair did not hold completely.

During the next three years various attempts at plastic repair in the vaginal vault were tried with varying success. At one time drainage was so slight that the patient wore only one pad daily. However, the condition became worse.

Various specialists were consulted. Advice varied but was usually one of four things, namely, implant into colon, perform a pyelotomy, and from two famous clinics, perform a nephrectomy. Ligation of the ureter was also advised. We persisted in our conviction that normal function could be restored.

We were advised that the bladder was hopelessly contracted. Intermittent treatment with antibiotics and urinary antiseptics was given to prevent cystitis and it was our opinion that in the absence of inflammation interstitial fibrosis in the bladder wall could not occur, that the muscle fibers could be coaxed back to practically normal. Dilatation of the bladder from time to time, with the fistulous openings clamped off, tended to confirm our belief.

Some four years after the first operation the patient was taken to a large clinic at the advice of relatives. There plastic closure from below was done and the patient was advised that should this fail, implantation into the colon, or nephrectomy, and closure of the remaining vesicovaginal fistula would be done.

The woman remained dry for approximately three months, at which time drainage recurred and she returned to us for help.

Although we expected to encounter a mass of scar tissue, we decided once more to attempt exposure of the ureter and implant into the bladder. The patient was readmitted March 18, 1952.

At operation on March 23rd the vaginal vault presented a sinus from the left ureter, with also an adjacent opening into the bladder. Toward her right fornix, when the bladder was distended with dye solution, a small pin-point opening was discovered.

With the patient in the high Trendelenburg position a low transverse abdominal incision was made, excising the scar of one of the previous operations. The bladder was found, opened and explored. Incidentally, a large closed cyst some 20 cm. long was found to the left, containing a serous fluid. Since it was subperitoneal, we concluded it followed the operation of October, 1948, when the ureter was stripped up some distance. After some effort the ureter was located by palpation and the end dissected free for perhaps 8 to 10 cm. It was normal in size. No urine escaped from the ureter although observed for at least twenty minutes. A ureteral x-ray catheter was inserted and threaded upward 5 to 6 cm. The left kidney was palpated and found normal in size. It was thought by one of us that the renal suppression was only temporary. Accordingly, the ureter was implanted into the bladder a little to the left of the midline and the abdomen was closed in layers. As usual, a Foley catheter was inserted into the bladder. This operation consumed some six hours.

On April 10th a pyelogram revealed good function in both kidneys, with no evidence of hydronephrosis or urinary obstruction. The bladder was reported reduced in size with a deformity on the left. There was a triangular collection of dye between the bladder and the left ureter, with pointed end or apex inferior, which was thought to be a fistula between bladder and vagina. Ureterovesical anastomosis was working well.

It was now our opinion that we had only to deal with the vesicovaginal fistula. A careful check revealed the old fistula draining, plus at least one pin hole on the other side.

It was planned to close the fistulous openings and the patient was readmitted April 30, 1952.

On May 1st, under spinal anesthesia, the Mayo technic was again used, exposure being made as usual with a Gott self-retaining speculum. To invert the cuff, a fine ureteral catheter was passed through the vaginal opening and into the bladder. The end was gently brought out of the urethra with a bent blunt hook on the end of a fine probe. A small rubber catheter was next threaded over the urethral end and brought out into the vagina where the ureteral catheter was withdrawn. A No. 1 chromic suture was next threaded up through the catheter from the vaginal end. After carefully closing the cuff of tissue with fine silk sutures, the ends of the last were tied to the chromic suture and the latter pulled down and out the urethra after withdrawing the catheter, thus invaginating the cuff into the bladder. The suture was not tied into the labia but was cut off at the external urinary meatus.

The other small fistulous opening was denuded by an ellipse of mucosa, closed with a purse-string suture and the mucosa was sutured, hoping this would be sufficient. A Foley catheter was inserted.

On May 15th the vaginal vault appeared dry and the bladder capacity was 350 cc. Later the patient returned complaining of a small amount of urinary drainage. On distending the bladder with methylene blue solution, two or three fine pin-point openings in an area 1 cm. in diameter were found toward her right and halfway up the vaginal vault. The former repair was healed.

The patient was hospitalized for the seventeenth time October 7, 1952, and operated upon two days later under intravenous pentothal® and nitrous oxide anesthesia. A technic similar to that of the last repair was employed except that the area of pin-hole sized openings had to be enlarged to include all. A fine probe was inserted from below, the ureteral catheter passed along it and the bladder end fished out via the urethra. The two ends were clamped and laid upon the abdomen. A cuff of tissue to include the area was encircled and the area was closed with a fine purse-string suture; the needle was passed through the catheter and tied. A heavier reinforcing suture was left long and tied to the fine suture. The catheter was withdrawn from bladder and urethra, and the cuff of tissue thus invaginated into the bladder. The heavy suture was threaded and passed as a mattress suture through one labium under

moderate tension. This was divided below the meatus several days later.

The patient was discharged, dry, on October 27th. She resumed her duties as a practical nurse and has been in good health since, a period of some twenty-three months, except for a cholecystectomy for chronic cholecystitis on July 7, 1954, being discharged on July 12th. She is in good health and working.

A pyelogram taken on October 10, 1953, one year after the last operation, revealed no hydronephrosis and excellent excretion from both kidneys. There was no dilatation of the left ureter and no displacement. The only abnormality noted was a slight diverticulum on the left side of the bladder, probably at the site of the ureteral implant because of a loss of 1 inch or more of the ureter.

The bladder capacity has steadily improved but of late has become stationary at a satisfactory level and the patient states she is well satisfied.

SUMMARY

Accidental severance of ureter should not be an indication for nephrectomy or implantation into the colon; this may often result in ascending infection and finally nephrectomy, as would ligation of the ureter. The aim should be to conserve the kidney. Implantation into the bladder is still possible with a careful and painstaking approach, and bladder function may be restored, if infection of the bladder is prevented, even years later.

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Early Ligation in the Treatment of Injuries to Cervical Portion of Thoracic Duct

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ALTHOUGH a great deal has been written about the management of injuries to the thoracic portion of the thoracic duct, there is little in the literature regarding injuries to its cervical portion. If an injury to the cervical portion of the duct is not recognized and if the duct is not ligated, prolonged drainage of chyle ensues. Spontaneous healing of the chylous fistula is slow and the persistent drainage is a nuisance. This sequence of events may be avoided if the patient is operated upon again and the duct ligated as soon as the complication is recognized.

CASE REPORT

The patient was a young woman who gave a history of having had a thyroid lobectomy for papillary carcinoma of the thyroid. A firm lymph node 2 cm. in diameter was palpable in the left mid-cervical region and a neck dissection was advised.

Under general anesthesia a left neck dissection was performed and the fat and lymph node–bearing tissue was removed from the superior mediastinum. The dissection was easy and no technical complications were noted during the procedure. The thoracic duct was not seen.

Twenty-four hours after operation it was noted that there was an unusual amount of serum in the wound. Forty-eight hours after operation aspiration of the fluid showed it to be milky; a diagnosis of injury to the thoracic duct was made, and the patient was operated upon again. The leak in the thoracic duct was pouring out a thin milky fluid and was found without difficulty. The duct was ligated; the wound healed promptly and the patient went on to an uncomplicated convalescence.

COMMENT

It is likely that many surgeons have reoperated upon and ligated injured thoracic ducts, but recent surgical literature makes little or no mention of this method of treatment for injuries to the cervical portion of the duct. Since prolonged disability may attend conservative treatment of a leaking duct, it is preferable to explore the neck as soon as the diagnosis of chylous effusion is made. Feeding the patient a little cream a short time before the operation may make it easier to find the end of the duct.

SUMMARY

The cervical portion of the thoracic duct was injured in the course of a neck dissection. Two days after operation the collection of chyle in the wound was recognized. The duct was ligated without delay and the patient's convalescence was uneventful.

A Nerve Stimulator Providing Easy Identification of the Facial Nerve and Its Branches

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IN operations for radical resection of the parotid area for malignancy and radical neck resections one of the chief worries for the surgeon is that the facial nerve and the spinal accessory nerve, respectively, be not only identified but also carefully preserved. Actually, one cannot carry out definitive surgery of the parotid until the main trunk of the seventh cranial (facial) nerve has been identified and exposed as well as its five main subdivisions. Frequently, tumor tissue is so widespread and normal anatomy so distorted that ultimately the danger of permanently injuring nerves of this type is great. Indeed, the use of

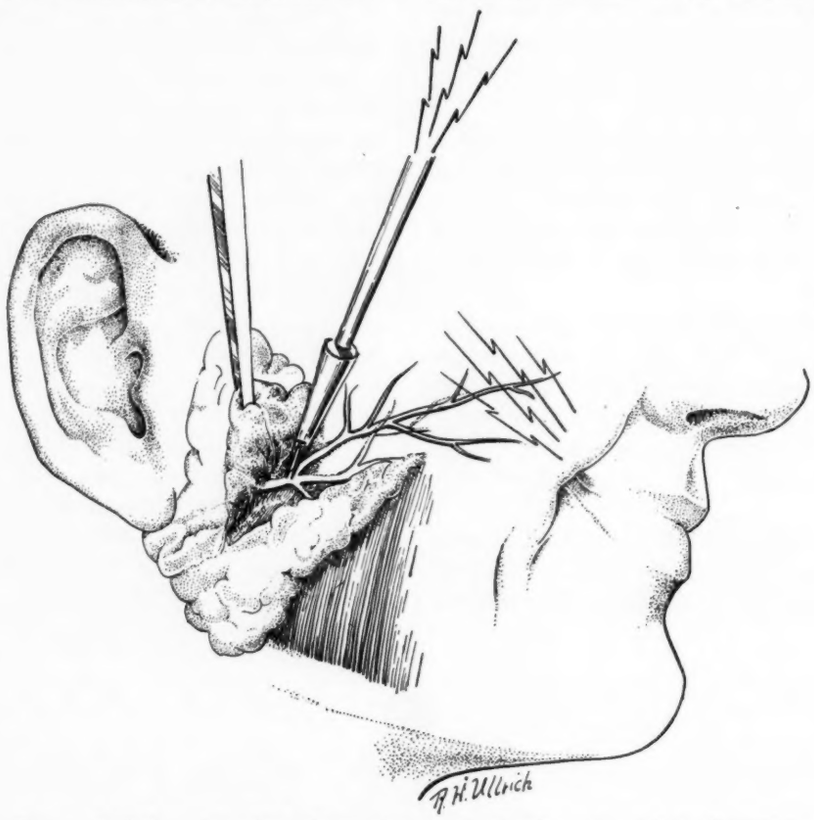

FIG. 1. Artist's conception of how the nerve stimulator is used in dissections of the parotid region. There is demonstrated actual contact of the bipolar electrode with the buccal branch of the facial nerve with resultant stimulation of the orbicularis oris muscles and retraction of the corner of the mouth.

FIG. 2. Output: 60 cycle sine wave derived through a step-down transformer from the alternating current line voltage. The voltage is easily adjusted from 0.2 to 10.0 volts. Physical size: 3 by 4 inches or slightly larger, probably 2 by 4 by 10 inches. Electrodes: bipolar, pencil type, with nylon tip insulation. Any length of cable wanted can be supplied; unless specified, 6 foot cables will be supplied. These electrodes, with cable, can be autoclaved. Two pencil type electrodes are supplied with the stimulator.

a nerve stimulator might not only be considered for the parotid and neck region but also the axilla in radical breast surgery, surgery of the brachial plexus and in other areas where the hazard of dividing an important motor nerve structure is great.

The outstanding advantage of the instrument to be described is that it instructs the surgeon when he is close to or approaching the nerve he wants to identify and preserve. Actually, it provides for stimulation of the nerve without actually coming in direct contact with it. Under such circumstances the muscular response is not as great but is sufficient enough to warn the operator that the object of his search is close by. The rami of the facial nerve are so tiny that it is extremely difficult to recognize them grossly even when completely exposed. Operative trauma to the facial nerve often causes temporary paralysis for several days or weeks. It is comforting for the surgeon to know that the paralysis is temporary and not permanent. (Fig. 1.)

Another possibility for the use of this instrument is the demonstration of intact nerve trunks in severe injuries to the extremities. Although actually I have never used this instrument for such a purpose, it would certainly be feasible.

In using this instrument one must be certain that the meter has not jumped its bearings. The needle should move smoothly when the unit is rocked from side to side prior to actual use.

In use, the Marshall stimulator* is plugged into a standard 110 volt, 60 cycle alternating current line. The meter is adjusted to the

* Dr. Curtis Marshall, Baltimore, Maryland.

desired voltage by a knob marked "meter set" and the percentage of the meter voltage wanted in the electrodes is determined by a knob marked "% of meter." (Fig. 2.)

The stimulating electrodes may be autoclaved but will not withstand too much cord trauma. It has been found that the heavy, extremely durable cords are just too cumbersome to be worth while and practical; it is easy enough to replace the light cords when necessary.

A wire should be run from a terminal marked "G" to a good ground to prevent static trouble.

To check that this unit is functioning correctly: with the electrodes *not* plugged in, set the meter at 4.0 volts; then set the "% of meter" at 100 per cent. Plug in the electrodes. Then the meter reading should not be altered. If the meter reading drops, there is a short circuit somewhere in the electrodes. Now short circuit the silver tip wires with some metal such as a hemostat. The meter reading should drop to zero. If it does not, there is an open circuit in the electrode wire or assembly.

SUMMARY

A nerve stimulator has been described which provides for easier recognition of motor nerves in surgery of the parotid region and radical neck dissection.

The instrument is durable and relatively inexpensive. It is of inestimable value in locating motor nerves of small caliber, and their injury can thereby be avoided.

A Modified Biopsy Forceps for Peritoneoscopy

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THE biopsy forceps for the Ruddock peritoneoscope has been modified several times by Dr. Ruddock since its first inception. These modifications have consisted of getting the jaws to open wider and in making the biting surface a "parrot's beak." This makes it possible to get a good deep bite on the tissues biopsied.

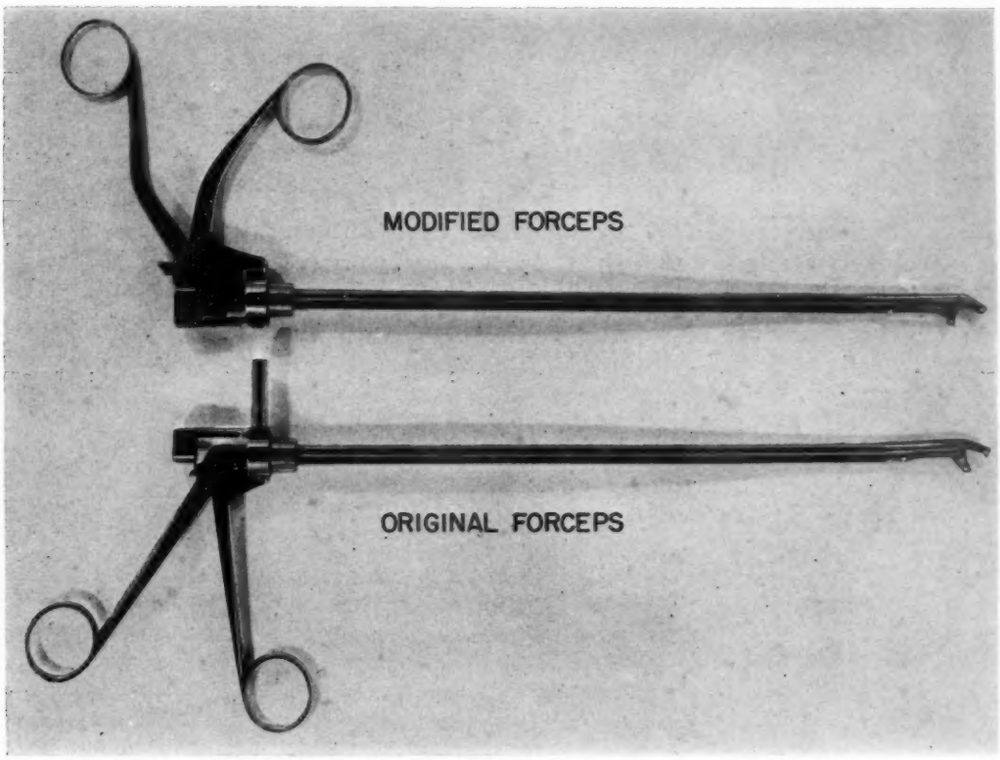

FIG. 1. Photograph of original and modified forceps, showing reversal of operating handles and biopsy jaws.

The present forceps is an excellent instrument. However, there are numerous times when it is difficult to use in an individual with a large abdomen, either due to obesity or distention from ascitic fluid. This is true even though the fluid has been removed, since we always replace it with air for visualization. The difficulty is due to the fact that the moving lever to open the jaws is the front one and often down tight on the abdominal wall. This leaves no room to move this lever and thus open the jaws of the forceps to obtain a bite of tissue. Sometimes this can be accomplished only by letting some air out of the peritoneal cavity and thus allowing the abdominal wall to fall away. However, this cuts down on the size of the cavity and may interfere with visualization. Another method I have frequently used was to open the forceps upside down and take the biopsy from the edge of the liver. This worked fairly well at times but still pushed the terminal for the coagulating elec-

trode against the abdominal wall, making a tight fit. Also, the biopsy obtained in this way was often too thin.

This maneuver gave me the idea for the present modification of the Ruddock forceps, i.e., merely reversing the direction of operating handles and biopsy jaws, with the terminal pole for the coagulating current coming in from the side. I am presenting it herein as I believe it will be most helpful to those doing peritoneoscopy. (Fig. 1.)

The modified forceps makes it easy to take a biopsy from the liver, or a tumor mass, with the operating handles in the up position, or from the parietal peritoneum with the handles down.

I have used this modification now for over a year and a half in many hundreds of cases. I believe it obviates the mentioned difficulties with the present biopsy forceps and I use it exclusively although the other model is still available.

CONCLUSION

A modification of the biopsy forceps* for the Ruddock peritoneoscope is submitted. It has been successfully used over the past year and a half in many hundreds of cases.

* The modified forceps is made by the American Cystoscope Makers, Inc., New York, N. Y., who make the Ruddock peritoneoscope.

PRIMARY malignancy arising in the fallopian tubes is very rare. Pathologists emphasize that these growths are usually unilateral and metastasize early into the endometrium. Panhysterectomy plus removal of both tubes and ovaries is the only effective therapy. Prognosis depends on the presence or absence of other metastases. (*Richard A. Leonardo, M.D.*)

Suction Tubing and Tip-holding Forceps

JOHN M. LORÉ, JR., M.D., *New York, New York*

From the Department of Surgery, Saint Clare's Hospital, New York, New York.

DURING surgical procedures which require the use of a suction apparatus some difficulty may be encountered in the maintenance of both the suction tubing and tip in a proper and fixed position relative to the operative field.

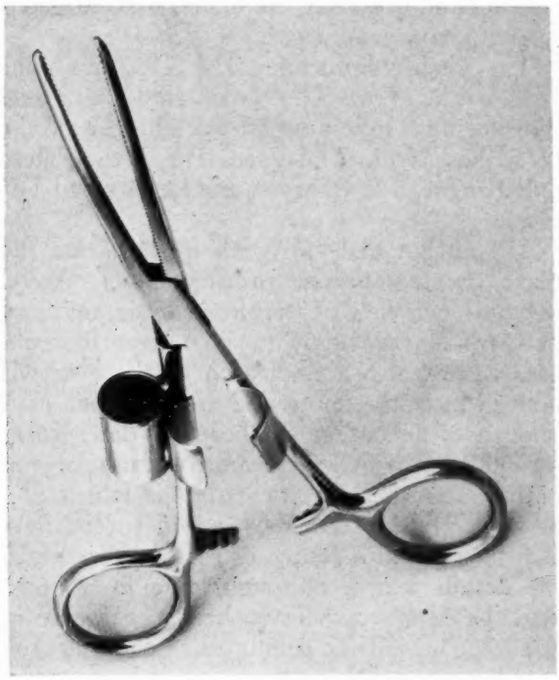

FIG. 1. The instrument viewed from above to show the two sleeves; one to hold the suction tip and the other, in two sections, to hold the tubing.

The usual methods of fixation are varied and frequently predispose to contamination. In an effort to standardize the method of fixation of both the suction tubing and the suction tip in the operative field, an instrument was designed.

The instrument* (Fig. 1) consists of a medium-sized curved (Kelly) clamp (15 cm.), to the shanks of which are attached two metal sleeves (2 cm.); one holds the suction tip and the other, in two sections, holds the suction tubing. When the clamp is anchored to a fold of the drapes, the tubing is firmly grasped by the two sleeve sections. (Fig. 2.)

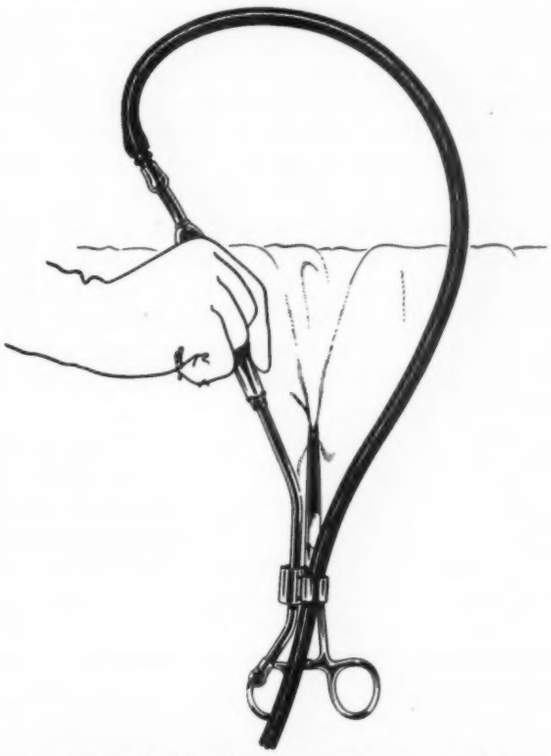

FIG. 2. Drawing to illustrate the instrument in use.

The advantages in the use of this instrument are: (1) its ready adaptability to any type of operative field; (2) it is easily and quickly assembled; (3) it is readily maneuvered and (4) there is less likelihood of contamination.

* Manufactured by Edward Weck & Co., Inc., Brooklyn, N. Y.

BOOK REVIEWS

Mayo Clinic Diet Manual. By The Committee on Dietetics of the Mayo Clinic. Second edition, 247 pages. Philadelphia, 1954. W. B. Saunders Co.

The writer of this review is not a dietitian but a surgeon. Cases of a medical nature that require special diets usually have such diets planned by their physician. In most instances, diets which are essential and indicated following certain surgical procedures are planned by the hospital dietitians. It impresses us that we surgeons might occupy some of our time in becoming familiar with this important subject. If the reader is an individual conversant with this subject, he will find it profitable to linger through the pages of this informative book which covers the subject thoroughly. This new edition has been corrected and modernized, changes have been made in many dietary programs, height-weight tables have been revised. Standard tube feeding has been changed and a trial diet for food elimination has been added, as well as a table showing the caloric values of beverages and snack foods.

Although this book considers the many diets necessary as part of the treatment of medical ailments, there are also many diets essential to the success of surgical operations. The Appendix is fascinating and instructive reading.

This book deserves and should have a wide distribution. From a dietary viewpoint it has "everything."

Anatomy for Surgeons. The Head and Neck. By W. Henry Hollinshead, PH.D. Volume 1, cloth binding, 560 pages, 326 illustrations. New York, 1954. Paul B. Hoeber, Inc. *Price* $12.00.

This is an excellent, solid and scientifically interesting work. Throughout the text one discerns the hand of the finished and exceptional anatomist and teacher.

This is the first of a three-volume anatomic series. The other volumes deal with "The Thorax, Abdomen and Pelvis" and "The Back and Limbs." The author informs us that after he completed each chapter he submitted it to friends and colleagues of the Mayo Clinic for reading and criticism. He names nine surgeons who did this work.

The chapters include: The Cranium, The Orbit, The Ear, The Nose and Paranasal Sinuses, The Fascia and Facial Spaces of the Head and Neck, The Face, The Jaws, Palate and Tongue, The Pharynx and Larynx and The Neck.

The author had two goals in preparing the text: "First, to present to the younger surgeon not only a review of the broad basic anatomy with which the surgeon is necessarily concerned, but also a discussion of those details upon which the more mature surgeon, consciously or unconsciously, bases his daily work; second, to provide for the more mature surgeon both a refresher for these details which are, perhaps, slightly outside his own special field of interest, and a source of ready reference to the details which, although lying in his own field, he cannot expect to keep constantly in mind." The author fulfills this blueprint 100 per cent.

The illustrations are purely diagrammatic line drawings "and are planned to accompany the text in much the same manner that one draws diagrams upon the blackboard to illustrate points in a lecture."

Many surgeons, young and old, will find this a book of great practical worth.

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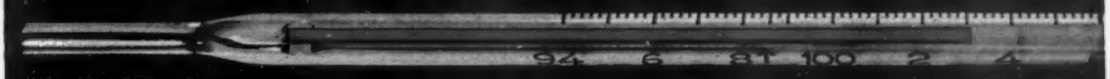

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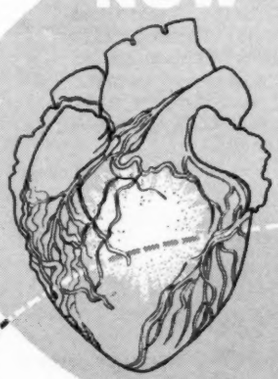

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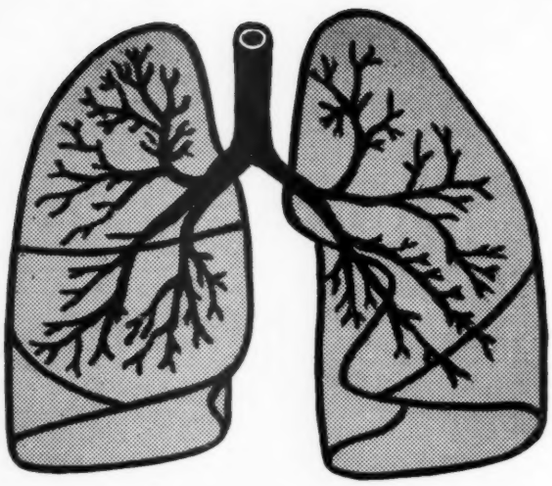

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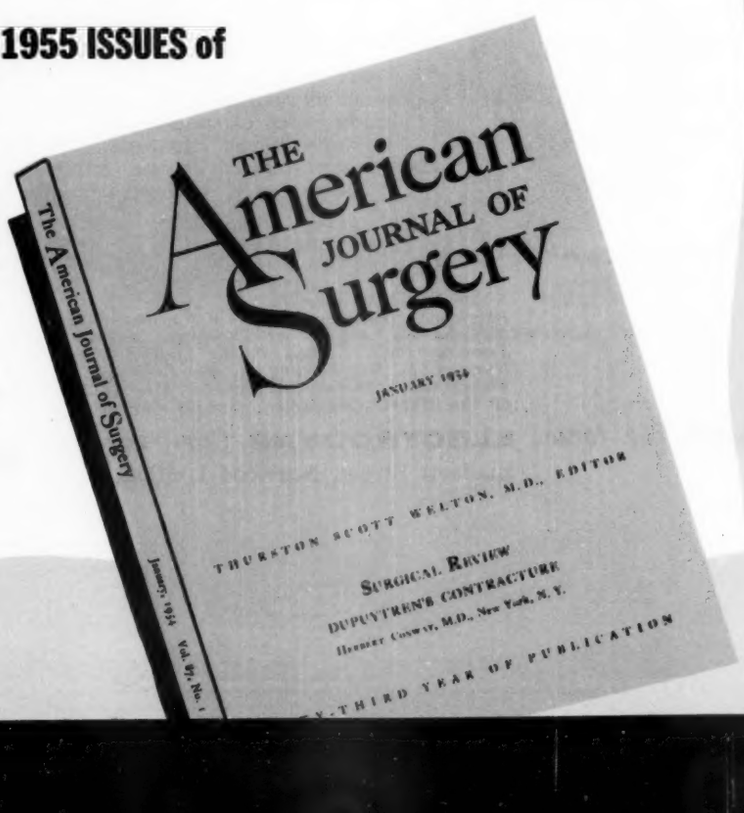

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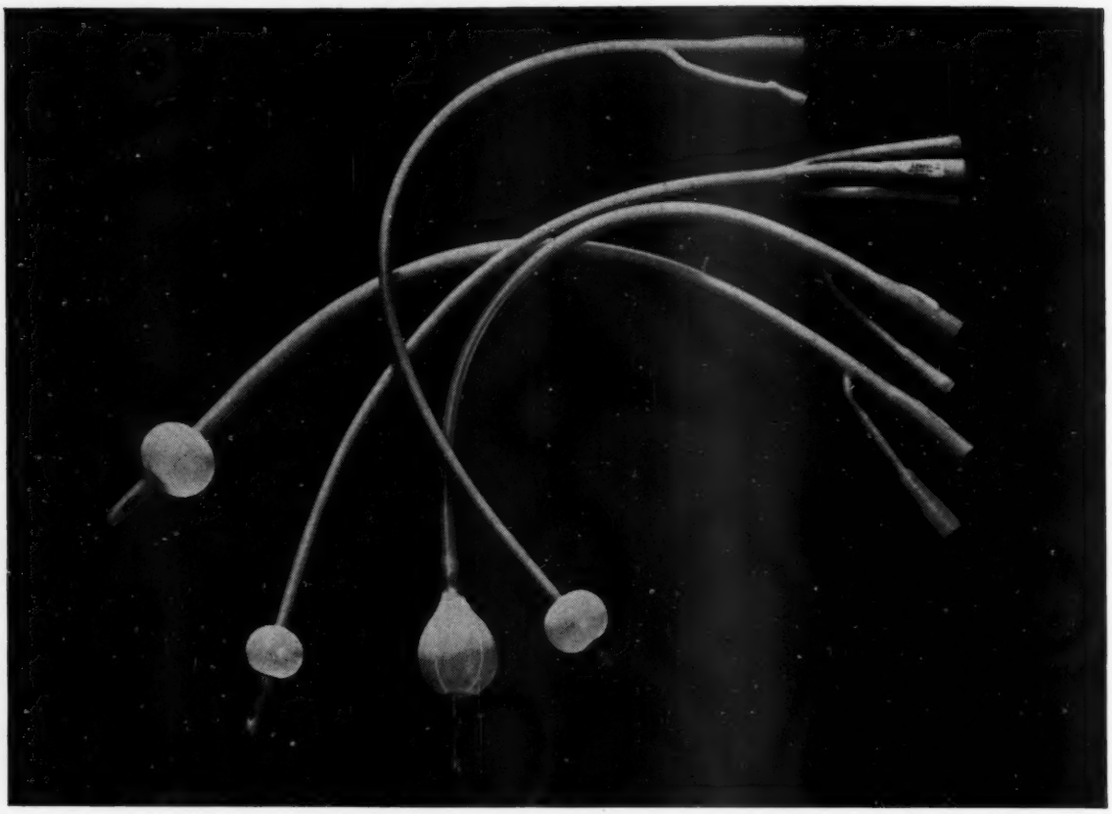

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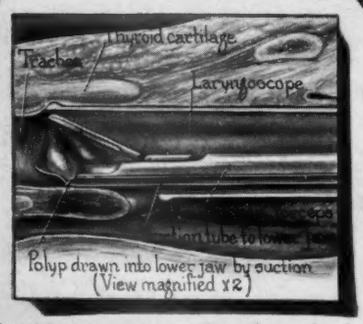


Illustration shows a polyp drawn by suction into lower jaw of Broyles laryngeal suction forceps.

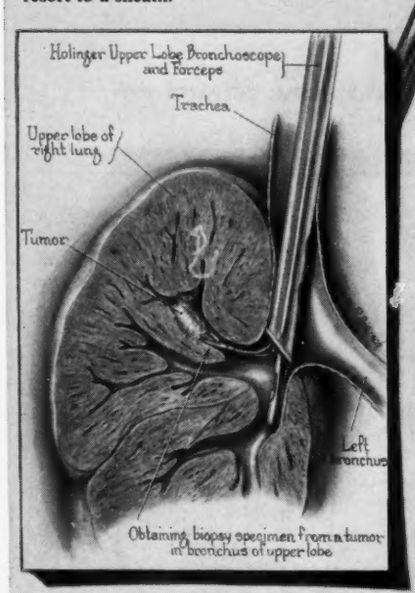
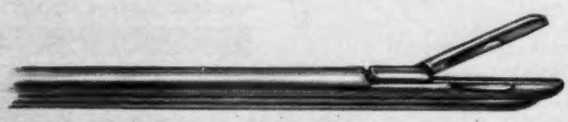
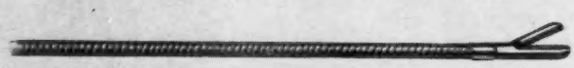

Holinger Upper Lobe Bronchoscope and Forceps
Trachea
Upper lobe of right lung
Tumor
Left bronchus
Obtaining biopsy specimen from a tumor in bronchus of upper lobe

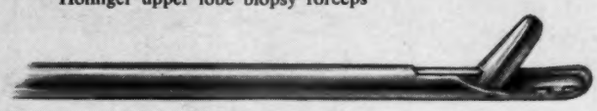
Illustration shows a biopsy specimen being obtained from a tumor with the Holinger upper lobe biopsy forceps.



Broyles laryngeal suction forceps

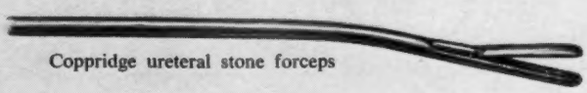


Holinger upper lobe biopsy forceps



Lowsley grasping forceps

Turell rotating rectal biopsy forceps



Coppridge ureteral stone forceps

WRITE FOR LITERATURE DESCRIPTIVE OF THE MANY OTHER TYPE FORCEPS.

ESTABLISHED IN 1900 — BY REINHOLD WAPPLER

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American Cystoscope Makers, Inc.

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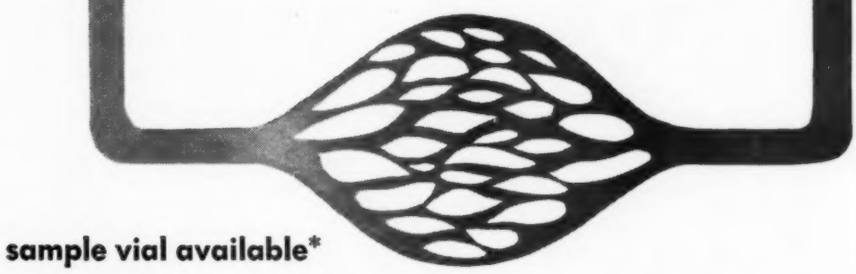
you can duplicate these results in control of bleeding . . .

Conclusions from a 1954 report on KOAGAMIN in the American Journal of Surgery

rapid	acts promptly—usually with 1 or 2 injections
safe	no untoward effects in over 11 years' use
prophylactically	facilitates surgical procedures tends to reduce blood loss
therapeutically	particularly valuable in general oozing fully compatible with vitamin K
saves blood	often obviates use of transfusions

Joseph, M.: Am. J. Surg. *87*:905, 1954

KOAGAMIN® ***parenteral hemostat***



sample vial available*

KOAGAMIN, an aqueous solution of oxalic and malonic acids for parenteral use, is supplied in 10-cc. diaphragm-stoppered vials.

*Write Dept. A for your full-sized vial of KOAGAMIN and literature defining its many uses in everyday practice.

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Molds and holds to any contour . . . Allows joint motion . . . Provides firm support and controllable compression . . . Does not slip. Assures the neatest, most comfortable dressing in private and hospital practice. Available at your dealer in widths of 1, 2, 2½, 3, 4, 5 and 6 inches, 3 yards long (slack).

*** Elastoplast is also available in convenient unitdressings and compresses. Write for literature.**

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the Solution of Choice for the Rapid Disinfection of Delicate Instruments

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4. Non-toxic, non-staining, and stable.
5. Potently effective, even in the presence of soap.
6. Economical to use.

**Trademark of Sindar Corp.*

for WARD CLINIC OFFICE

Compare the killing time of this superior bactericidal agent		
Vegetative Bacteria	50% Dried Blood	Without Blood
Staph. aureus	15 min.	2 min.
E. coli	15 min.	3 min.
Strept. hemolyticus	15 min.	15 sec.

In choosing B-P CHLOROPHENYL, you avail yourself of a medium free from phenol (carbolic acid) or mercury compounds . . . one highly effective in its rapid destruction of commonly encountered vegetative bacteria (except tubercle bacilli). See chart.

Ask your dealer

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No. 300 B-P INSTRUMENT CONTAINER is suggested for your convenient and efficient use of BARD-PARKER CHLOROPHENYL. Holds up to 8" instruments.

the
fourth dimension
of
PREFERRED local anesthesia

Xylocaine® Hydrochloride (Astra) merits special consideration by the busy anesthesiologist and surgeon. Profound in depth and extensive in spread, its well-tolerated effect is more significantly measured by the time saved through its remarkably fast action, by which so much normally wasted "waiting time" is converted to productive "working time".

Stocked by leading wholesale druggists and surgical supply houses as a ½%, 1% or 2% solution without Epinephrine and with Epinephrine 1:100,000. 2% solution is also supplied with Epinephrine 1:50,000. All solutions dispensed in 50cc. and 20cc. multiple dose vials, packed 5x50cc. or 5x20cc. to a carton.

XYLOCAINE® HCL

Pronounced Xi'lo'cain

(Brand of lidocaine *HCL)

AN AQUEOUS SOLUTION

A 4th dimensional approach to preferred local anesthesia

Bibliography available on request

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a favorite

prescription

the year 'round

to **accelerate**

healing

DESITIN® ointment

the pioneer external **cod liver oil** therapy

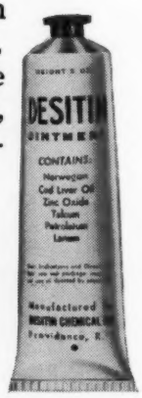
New impressive studies[1] again confirm the clinical value[2-4] of Desitin Ointment to protect, soothe, facilitate healthy granulation, and speed healing even in stubborn skin conditions often resistant to other therapy.

in **wounds • burns • ulcers** (decubitus, varicose, diabetic)

diaper rash • intertrigo

non-specific dermatoses • perianal dermatitis

Protective, soothing, healing, Desitin Ointment is a non-irritating, non-sensitizing blend of high grade Norwegian cod liver oil (with its unsaturated fatty acids and high potency vitamins A and D in proper ratio for maximum efficacy), zinc oxide, talcum, petrolatum, and lanolin. Desitin Ointment does not liquefy at body temperature and is not decomposed or washed away by secretions, exudate, urine or excrements. Dressings easily applied and painlessly removed. Tubes of 1 oz., 2 oz., 4 oz., and 1 lb. jars.

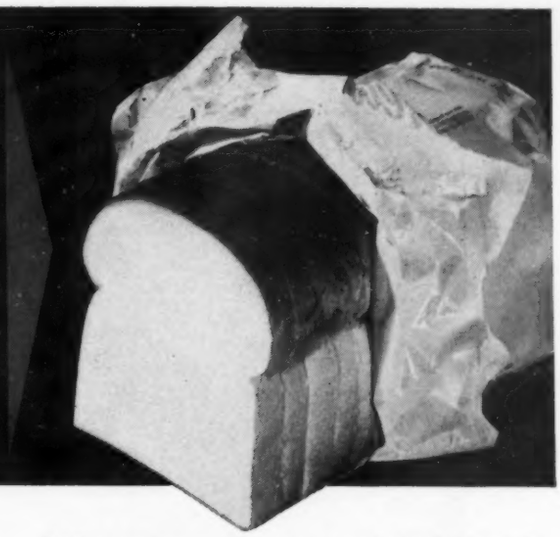


samples and reprint[1] on request

DESITIN CHEMICAL COMPANY
70 Ship Street, Providence 2, R. I.

1. Grayzel, H. G., Heimer, C. B., and Grayzel, R. W.: New York St. J. M. 53:2233, 1953.
2. Heimer, C. B., Grayzel, H. G., and Kramer, B.: Archives of Pediatrics 68:382, 1951.
3. Beerman, H. T., Combes, F. C., Bobroff, A., and Leviticus, R.: Ind. Med. & Surgery 18:512, 1949.
4. Turell, R.: New York St. J. M. 50:2282, 1950.

Enriched Bread in *Dietary Planning*



BECAUSE of its nutritional, dietetic, and physiologic values, enriched bread simplifies in many ways the organization of dietaries suited to the special requirements of patients.

FOR THE SURGICAL PATIENT...

The first solid food after surgery is toasted enriched bread, slightly buttered. This practice has become a tradition—almost a ritual—because of the very nature of toast. It is bland, easily digested, and yields little inert residue. Its golden, warm appearance is pleasing to the eye; its mild taste appeals to the palate. Its nutrient energy plays a role in the physiologic and psychologic re-awakening of metabolic processes depressed under the "nothing by mouth" conditions immediately following surgery. With increasing tolerance for food it becomes an important component of the soft diet and later of the therapeutic diet.[1] Its valuable protein, B vitamins, iron, calcium and calories help the patient to regain nutritional efficiency.

FOR THE CONVALESCENT...

Enriched bread figures prominently in the dietary regimen in convalescence after acute infections, other serious illness, or trauma.

Supplying 13 grams of high grade protein per 5½ ounces (estimated average daily consumption), enriched bread makes an important contribution to the daily protein need. Its protein, comprising flour, milk, and yeast proteins, functions in the healing of wounds and in the rebuilding of wasted tissues.[2] In addition, 5½ ounces of enriched bread supplies on the average 0.37 mg. of thiamine, 0.23 mg. of riboflavin, 3.4 mg. of niacin, 4.1 mg. of iron, 137 mg. of calcium, and 418 calories.

FOR THE CHRONICALLY ILL...

In the formulation of palatable and nutritious menus for the debilitated, chronically ill, the advantages of enriched bread serve well.

In anorexia, enriched bread or toast stimulates the appetite. It is easily masticated and readily digested, features particularly important for elderly patients. Its favorable textural influence within the alimentary tract[3] promotes good utilization of ingested foods.

---

1. The Committee on Dietetics of the Mayo Clinic: Mayo Clinic Diet Manual, ed. 2, Philadelphia, W. B. Saunders Company, 1954.
2. Sherman, H.C.: Chemistry of Food and Nutrition, ed. 8, New York, The Macmillan Co., 1952, pp. 212, 599.
3. Sherman, H.C.: The Nutritional Improvement of Life, New York, Columbia University Press, 1950, p. 133.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

AMERICAN BAKERS ASSOCIATION
20 NORTH WACKER DRIVE • CHICAGO 6, ILLINOIS

Olecranon bursitis

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FASTER, MORE EFFECTIVE RESPONSE

WYDASE adds *speed* to local anesthesia by adding *spread* to the anesthetic. This is because WYDASE is a spreading-agent—an enzyme that temporarily opens the intercellular barriers and hastens the diffusion of injected fluids. WYDASE improves the anesthetic response in numerous surgical procedures. Promotes faster onset, increased area of anesthesia, virtual freedom from tissue distention. Merely mix with the anesthetic solution.

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- *Sprains*
- *Tendinitis*
- *Myositis*
- *Closed reduction of simple fractures*
- *Saphenous-vein ligation*
- *Pudendal nerve block*
- *Oral and dental surgery*
- *Cosmetic surgery*
- *Ophthalmic surgery*

Other uses: WYDASE is also used for reduction of swellings, speeding fluid absorption in hypodermoclysis, facilitating separation of fibrous adhesions, improving insulin-coma induction in schizophrenia.

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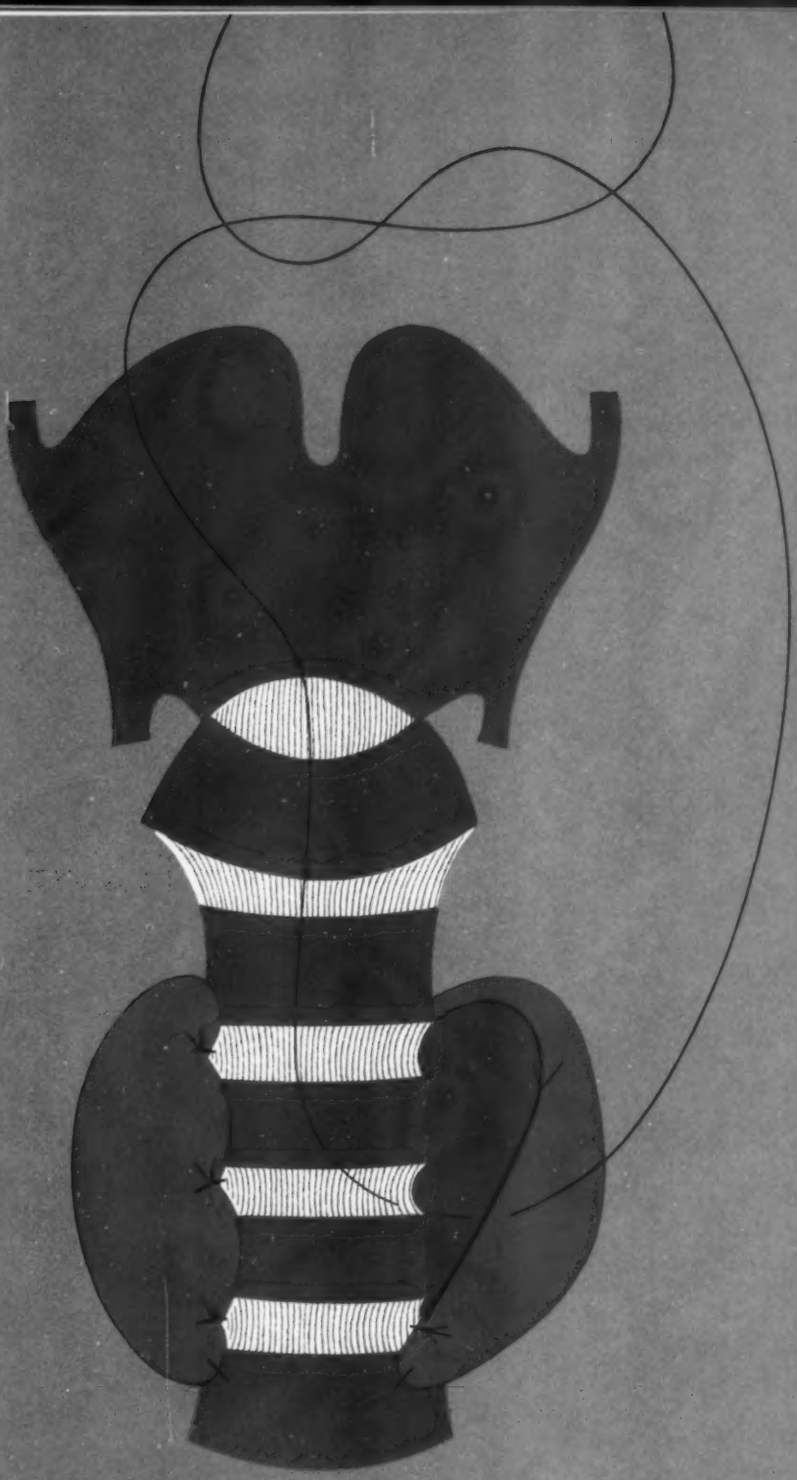
Philadelphia 2, Pa.

INJECTION SOLUTION
WYDASE®
Hyaluronidase (Stabilized)

Supplied: Vials of 1 cc., 150 TR (turbidity-reducing) units. Also available: Lyophilized WYDASE. *Supplied:* Vials of 150 and 1500 TR units.



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Upjohn

to avert adrenal crisis in acute stress:*

Intravenous Cortef**

Supplied in 20 cc. ampoules

Each ampoule contains:

Hydrocortisone.....100 mg.
Alcohol.....50%
Water for injection.....q.s.

For use in preparing intravenous *infusion* only.

***shock, emergency surgery, trauma, etc.**
****Registered trademark for the Upjohn brand of hydrocortisone (compound F)**

The Upjohn Company, Kalamazoo, Michigan

Meat...

and the management of cirrhosis

A recent review and analysis of the advances made in the management of cirrhosis of the liver during the last fifteen years shows that effective treatment, especially before irreversible changes have occurred, today includes a diet providing 150 grams of protein daily.[1] This high protein diet, first reported in 1941,[2] represented a revolutionary change from previous thinking. It has played an important rôle in the prolongation of life for countless cirrhotic patients.[1]

In addition to other foods from animal sources, three servings of lean meat daily have been used to assure the protein adequacy of the therapeutic regimen.[3]

The maximum use of meat appears "to be advisable because of the necessity for providing the essential amino acids which contain the basic methyl groups, with and without the sulfur radical. These methyl groups are required for the transmethylation function which institutes regeneration and healing in cirrhosis."[3]

Furthermore, although this point remains controversial, clinical observations suggest either that lipotropic agents supplementary to those supplied by the high protein diet are superfluous[4] or that their beneficial action remains to be demonstrated beyond doubt.[5]

Cooked lean meat provides from 25 to 30 per cent of high quality and highly available protein. It contributes also valuable amounts of B vitamins, including choline and B_{12}, and of iron, phosphorus, and potassium. Its high content of choline and methionine constitutes an important source of labile methyl groups.

---

1. Morrison, L. M.: Treatment of Cirrhosis of the Liver—Recent Innovations, Am. J. Gastroenterol. *21*:27 (Jan.) 1954.

2. Patek, A. J., Jr., and Post, J.: Treatment of Cirrhosis of the Liver by Nutritious Diet and Supplements Rich in Vitamin B Complex, J. Clin. Invest. *20*:481 (Sept.) 1941.

3. Morrison, L. M.: New Methods of Therapy in Cirrhosis of the Liver, J.A.M.A. *134*:673 (June 21) 1947.

4. Nash, E. C.: Management of Portal Cirrhosis, J. Nat. M. A. *45*:395 (Nov.) 1953.

5. Portis, S. A., and Weinberg, S.: Recent Advances in the Medical Treatment of Cirrhosis of the Liver, J.A.M.A. *149*:1265 (Aug. 2) 1952.

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American Meat Institute

Main Office, Chicago . . . Members Throughout the United States

Your valued hands, Doctor, *NEED*

Acid Mantle Creme

to prevent "surgeon's hands"

A Therapeutic—A Prophylactic
***NOT* a Barrier Cream**

ACID MANTLE CREME—a buffered solution of aluminum acetate in a specially formulated hydrophilic base with a dermatologically correct pH of 4.2

For skin diseases in which there is an increased pH of the skin surface and/or a hypersensitivity to alkali, such as: Dermatitis of the hands in Surgeons, occupational Eczema due to primary irritants including soap and alkalis, Nummular Eczema, Bath Dermatitis, Winter Itch, Dry Skin and Seborrheic Dermatitis. *Write for Literature and Samples*

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DRY STERILE
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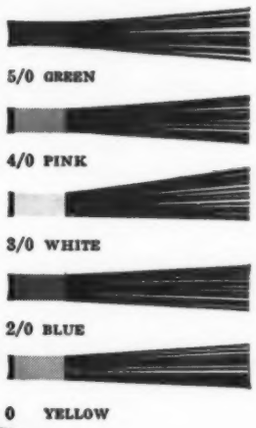
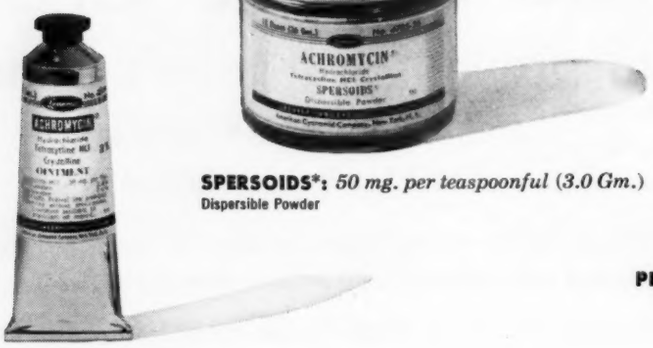


with **col-r-tips**
to identify the size

With COL-R-TIP, the size identification remains after the label reel is discarded.
The twelve strands are in perfect alignment, as plastic tip eliminates chance of tangling and kinking.
Readi-cut dry sterile comes in standard lengths of 18 inches, 24 inches and 30 inches. One dozen strands per tube—3 dozen tubes in jar or can—sterile-packed.

J. A. Deknatel & Son Inc.—manufacturers of surgical sutures and operating room specialties—96-20 222nd Street, Queens Village 29, (L. I.) New York.

When you think of Sutures, think of **DEKNATEL**



SPERSOIDS*: *50 mg. per teaspoonful (3.0 Gm.)*
Dispersible Powder

PEDIATRIC DROPS: *Cherry flavor. Approx. 25 mg. per 5 drops. Graduated dropper*

OINTMENT *(3%)*

ORAL SUSPENSION: *Cherry flavor. 250 mg. per 5 cc. teaspoonful.*

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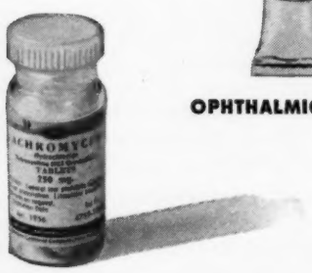
now available in these many convenient forms:

OPHTHALMIC OINTMENT *(1%)*



TABLETS: *250 mg., 100 mg., 50 mg.*

CAPSULES: *250 mg., 100 mg., 50 mg.*

INTRAVENOUS: *500 mg., 250 mg., 100 mg.*

SOLUBLE TABLETS: *50 mg.*

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OMYCIN*

Tetracycline Lederle

EAR SOLUTION (*0.5%*)

ACHROMYCIN, the new broad-spectrum antibiotic, is now available in a wide range of forms for oral, topical and parenteral use in children and adults. New forms are being prepared as rapidly as research permits.

ACHROMYCIN is definitely less irritating to the gastrointestinal tract. It is more rapidly diffusible in body tissues and fluids. It maintains effective potency for a full 24-hours in solution.

ACHROMYCIN has proved effective against beta hemolytic streptococcic infections, *E. coli*, meningococci, staphylococci, pneumococci and gonococci, acute bronchitis, bronchiolitis, pertussis and the atypical pneumonias, as well as virus-like and mixed infections.

*REG. U.S. PAT. OFF.

LEDERLE LABORATORIES DIVISION AMERICAN Cyanamid COMPANY Pearl River, N.Y. Lederle

NOTES AND QUOTES

MILLIONS of lives rescued from disease, addiction and poisoning stand today in living evidence of the research gifts of Dr. Arthur L. Tatum of the University of Wisconsin. However, as this seventy year old professor and chairman of the department of pharmacology retires, few of the lives he has touched will recognize his contributions, for Dr. Tatum is a victim of the anonymity of the laboratory research worker.

Interwoven with his forty-two years of teaching are forty years of research including investigations of conditions involving malfunction of the thyroid gland, the treatment of narcotic poisoning and drug addiction.

When Dr. Tatum came to the University of Wisconsin in 1928, he inherited an investigation in the field of specific chemotherapy, the use of drugs to combat infection, which was then underway and is still going on today. Most significant of the many contributions from this study was a new, safer and more effective treatment for syphilis in the form of a drug called "mapharsen" by Dr. Tatum.

This research man then turned his sights on malaria, a disease with frequent relapses. He and his associates found that these occurred in the presence of deficiencies of oxygen in the atmosphere, and that this lack interfered with the normal defensive mechanisms of the body.

In 1942 Dr. Tatum was awarded the Charles Mickle Fellowship by the University of Toronto "as the member of the medical profession who has done the most during the preceding ten years to advance sound knowledge of a practical kind in medical art and science." In 1948 he was awarded the degree of doctor honoris causa by Peru's national university, the Greater National University of San Marcos of Lima. The honorary degree, one of the very few and the highest ever bestowed by the school, was conferred on Dr. Tatum for his outstanding work in the field of pharmacology. The following year the scientist was made an honorary member of the Society of Biology of Montevideo.

Now that the time has come to step down, Dr. Tatum plans to shed the responsibilities of departmental chairman and teacher and devote his time to "the thing I enjoy most: research."

A twenty-minute color film on virus and rickettsial research has been produced by Lederle Laboratories Division, American Cyanamid Company.

Directed toward a general lay audience the film, entitled "The Smallest Foe," takes the viewer on a short tour of Lederle's modern virus research building normally prohibited to visitors. In addition, some of the theory, planning and importance of virus research and production is highlighted. An interesting feature of the film is an animated section describing the appearance of viruses, rickettsia, bacteria, etc. and how they grow.

Robert Gordon directed the film and L. D. Antoine and S. Aiston, both members of Lederle's virus research department, served as technical advisors in the writing and production.

The film will be shown to employees and visitors at Lederle Laboratories and will be available to television stations, clubs, schools and professional and civic organizations throughout the country. Prints may be obtained from: Film Library, Lederle Laboratories Division, American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y.

A NEW course, the only one of its kind in the West, will be University of California Extension's Dermal-Abrasion (Planing) class in the treatment of acne scars and other skin lesions starting late in September at General Medical and Surgical Hospital, Veterans Administration Center in West Los Angeles. It will meet on Wednesdays from 2 to 4 P.M., from September 29th to November 3rd.

The course is open only to graduates of approved medical schools with the consent of the course chairman, and is limited to qualified dermatologists and surgical specialists. The fee is $125.00. It will cover the anatomic and physiologic aspects, indications, selection of patients, technics and results of dermal-abrasion. Teaching will be accomplished through lectures, slides, patient demonstrations and manikin abrasion by students, according to Dr. Thomas H. Sternberg, head of Postgraduate Medical Extension at U.C.L.A.

Doctors interested in enrolling may apply to Dr. Sternberg at the University of California Medical Center, Los Angeles 24, California.

CONTINUED ON PAGE 56

YOUNG'S DILATORS

Extremely useful in the treatment and prevention of contracted anus (particularly following hemorrhoidectomy), as an aid in perineal dissection and repair following delivery.

Sold only on prescription—at your surgical dealer or ethical pharmacy

Adult Set sizes 1, 1½, 2, 3,—for stretching anal sphincter.
Children's Set sizes 0, 1, 1½, 2—for preventing contracted anus.
Infants Flexible Rubber sizes 000, 00, 0—uses above.
Size 3 and 4 drilled to take towel clamps—for use in perineal repair.

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November 14–19

See the very newest specialty instruments (American and imported) at Cochrane's booth at the A.C.O.S. convention.

You cannot afford to miss this display of a wide variety of instruments to be used in all the new techniques. Of course, all the instruments are in the same top quality plane that Cochrane has always maintained.

ALL GUARANTEED for one year, unequivocally.

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find MORE convenience and LONGER service with

PERRY APPLIANCES

large variety of models and sizes CUPS, BAGS, PROTECTORS and IRRIGATORS, MANY FEATURES found ONLY in PERRY appliances. Write for folders showing complete line.

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ALTERNATING PRESSURE POINT PAD

℞ for
- GREATER PATIENT COMFORT
- REDUCED NURSING CARE

A. P. P. Pads use is recommended at first indication of bedsores or for their treatment, especially where turning patient is undesirable. Over 3000 A. P. P. Units now in use provide statistics showing many hospitals gain 200% return on investment.

Call your hospital equipment dealer today | or contact mfr.

AIR MASS, INC. CLEVELAND 8, OHIO

TORBOT ILEOSTOMY & COLOSTOMY APPLIANCE

DEPENDABLE	1. Sealed to the skin in an air-tight bond. 2. Assures complete confidence to wearer. 3. Can be worn when swimming or bathing.
COMFORTABLE	1. Weighs less than 3 ounces. 2. Less than 3/16" in thickness.
PRACTICAL	1. Spout at bottom for emptying drainage. 2. Can be emptied at any toilet, affording wearer freedom of travel.
DURABLE	1. Lucite plastic ring. 2. Seamless latex pouch (reinforced).
ECONOMICAL	1. Detachable pouch.

A.M.A. Approved
Reprints on Request

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689 Eddy Street, Dept. J, Providence 3, Rhode Island

STRYKER Portable Suspension Traction Frame

For fractures of the femur in infants and children. Designed for Bryant traction and to simplify reduction. Fully adjustable for children up to seven years. Child can be taken home several weeks earlier.

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NOTES AND QUOTES

Davis & Geck has developed a special ligature dispenser after considerable research to provide the surgeon with a better and faster technic than that possible through the use of sutures wound on sponges, glass or rubber tubes and other devices. This ligature dispenser fits comfortably in the palm of the hand and enables the surgeon to get six to seven ties from a conventional 54 inch length of suture rather than the usual three or four ties. The dispenser is compact and is designed to permit steam to penetrate readily during sterilization.

DR. CLARENCE COOK LITTLE, Scientific Director of the Tobacco Industry Research Committee, recently announced the three main areas to be covered by the research program being financed by the tobacco industry group.

In order to find conclusive facts concerning questions that have been raised about tobacco use and health, Dr. Little said, the Scientific Advisory Board of the Tobacco Industry Research Committee has adopted a threefold policy which will direct funds into research on: (1) study of the physical and chemical composition of tobacco and accompanying products; (2) study of tissue changes in humans and in animals under various conditions; (3) study of smoking and other tobacco habits and of the emotional and physical makeup of smokers.

The Scientific Advisory Board, a group of outstanding scientists guiding the Committee's research activities, is completing its review of the first applications for specific research projects, said Dr. Little, who is also founder and director of the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Maine.

"Our outline of interests will lead us into broad fields of study that need much illumination," Dr. Little explained. He added: "While much excellent work has been done on the contents of tobacco itself, we want to look into this important subject by sponsoring original research to supplement or extend studies already conducted or under way. This investigation will include substances that are added to tobacco in its preparation for human use.

"Approaching the problem from another direction, we want to learn what changes, if any, take place in the different animal and human tissues when subjected under varying conditions to tobacco derivatives, smoke itself, as well as other potential irritants, such as air pollutants. We will be particularly concerned with the tissues of the mouth, larynx, lungs, endocrine and similar glands, the heart, circulatory system, the kidneys, nervous system, stomach and intestines, the skin and the lymph fluids.

"We also want to know more about tobacco habits and why people smoke—which leads us to the metabolism and the glandular and nervous systems of smokers. This segment of study could touch on certain statistical relationships between smoking and health but we would like to see some studies with penetration into the characteristics of the smoker and non-smoker, rather than just numerical computations."

Emphasizing that research to date has not succeeded in pinning down any single cause of cancer, Dr. Little cautioned against expecting "too many results too soon." He said the industry's program is a long-range one but that he has confidence it will ultimately contribute to a more rounded and detailed knowledge of the human body and its reaction to tobacco.

The Tobacco Industry Research Committee was set up early this year by leading cigarette manufacturers, organizations of growers and tobacco warehouse associations. Its purpose is to finance objective research on tobacco and health. Grants will be made to qualified individuals and institutions who will report their own findings. Dr. Little pointed out that the industry has made available an initial fund of $500,000 to be augmented as the need is developed by recommendations of its Scientific Advisory Board.

America's homemakers are so busy taking care of their family's needs that they often neglect their own meals. The diets of women over thirty are deficient in milk, foods that contain Vitamin C such as citrus fruits, and vegetables, according to a research report by Dr. Elizabeth Wiegand of the New York State College of Home Economics at Cornell University. Forty per cent of the women in the thirty to ninety year age group are overweight. Deficient diets not only affect the

CONTINUED ON PAGE 58

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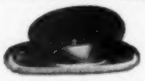

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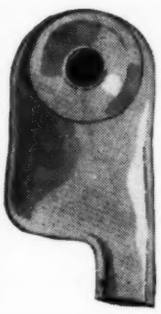

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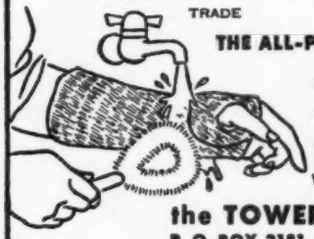

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NOTES AND QUOTES

physical health of homemakers, the report points out, but also manifest themselves in irritability, pessimism, nervousness and fatigue.

THE American Psychosomatic Society will hold its twelfth annual meeting at The Claridge Hotel in Atlantic City on Wednesday and Thursday, May 4 and 5, 1955. This meeting will be immediately preceded by those of the American Society for Clinical Investigation and the Association of American Physicians. It will be followed by the meeting of the American Psychoanalytic Association.

The Program Committee would like to receive titles and abstracts of papers for consideration for the Program no later than December 1, 1954. The time allotted for the reading of each paper will be twenty minutes. The Committee is interested in investigations in the theory and practice of psychosomatic medicine as applied to adults and children in all of the medical specialties, and in contributions in psychophysiology and ecology.

Abstracts for the Program Committee's consideration should be submitted in duplicate to Dr. Lawrence S. Kubie, Chairman, 551 Madison Avenue, New York 22, N. Y.

Fourteen outstanding medical school teachers and researchers have been named to receive grants totalling $270,500 this year from the Lederle Laboratories Division of the American Cyanamid Company. The Awards, believed to be the first of their kind in this field, are intended to augment salaries or to help schools fill teaching or research positions. Their basic purpose is to help assure that more promising medical men can afford to remain in teaching and research work at schools and universities.

TWO methods to aid scientists in their search for anti-arthritic drugs have been developed by University of Wisconsin endocrinologists Roland K. Meyer, Elva G. Shipley, Jacob C. Stucki and Kenneth A. Aulsebrook. The scientists also hope the methods will be of use in learning more about the conditions that give rise to the disease. They may even help scientists learn more about changes in hormone balance that take place during pregnancy.

The work has provided a hint that an as yet unidentified but powerful hormone is produced by the placenta or uterus during pregnancy. However, immediate use of the methods will probably be made in the hunt for anti-arthritic drugs which would not cause the undesirable side effects produced by cortisone and other natural hormones.

One of the methods is based on the fact that a particular kind of tissue known as granuloma tissue will grow into and around a small cotton pellet if it is inserted under the skin. The rate of tissue growth depends upon the level of cortisone and related compounds in the body. When the cortisone level is high, granuloma tissue growth is very slow. To test the effect of hormones and drugs, scientists insert cotton pellets under the skin of laboratory animals after a few days. The weight of the pellet and tissue reveals whether the hormones or drugs inhibit the growth of granuloma tissue. If they do, they may be helpful in arthritis and will be tested further.

The second method is based on the fact that knee joints of rats can be damaged by certain chemicals, and the inflammation resulting is similar to that of arthritis. The amount of damage can be measured by testing the permeability of joint membranes with dyes and radioactive tracers. Then the effect of cortisone and other anti-arthritic substances also can be measured.

It has been known for centuries that arthritic women often have no symptoms of arthritis during pregnancy. The reason is that additional quantities of cortisone or similar substances are released by the adrenal glands and possibly the ovaries, fetus and placenta. These hormones, which help the body meet the added requirements of pregnancy, incidentally reduce or prevent the inflammation of arthritis. The scientists say the same thing happens when animals are subjected to cold temperatures. Anti-inflammatory substances are produced in greater quantities and inflammatory reactions are reduced. Under both conditions, cold and pregnancy, the increased hormone production can be measured by the cotton pellets or the joint damage test.

The Wisconsin scientists say that a unique anti-inflammatory hormone may be produced by the placenta. Removal of any one of the

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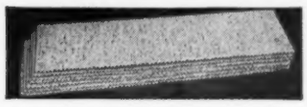

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cortisone-producing glands during pregnancy results in compensatory production by the others. However, removal of the placenta apparently results in a striking decline in total hormone level.

Additional research is now being conducted with placental tissue extracts to find and isolate the substance that apparently causes these effects or, if no such substance exists, to learn how the hormones produced during pregnancy protect the mother against inflammatory agents and stresses.

Because of their relatively high frequency as a cause of sickness and disability, ulcers of the stomach and the duodenum rank among the important chronic diseases. According to conservative estimates, approximately half a million people in our country have these conditions in active form. It has also been variously estimated that from 5 to 12 per cent of the population will be afflicted with ulcers in the course of a lifetime. In 1953 these disorders accounted for about 9,000 deaths in the United States, or a rate of 5.6 per 100,000 population.

The long-time trend in the mortality from peptic ulcer—that is, ulcers of the stomach and the duodenum—may be considered as falling into three periods: a steady rise to a peak about 1935; a subsequent decrease, the death rate reaching the lowest level in more than twenty years, by 1945; and a comparatively stable mortality at this level during the past eight years.

A PERUVIAN skull, 1,500 years old, wearing a precise duplicate of the oldest Western Hemisphere surgical dressing, will be a feature at the Johnson & Johnson exhibit of the evolution of surgical dressings this fall at the Smithsonian Institute.

For the sake of exactness, George Griffenhagen, associate curator of the Smithsonian's Division of Medicine and Public Health, took the skull to San Diego, along with original materials recovered from that era to duplicate the bandaging. In the Museum of Man in San Diego he modeled from a Peruvian skull which was found by the late Dr. Alex Hrdlicka, who had discovered several skulls showing that the surgeons of that period had used the trepanning operation.

This particular skull, found in a prehistoric cemetery in the Nasca region of Peru, still had the original roll of finely woven white cotton gauze held in place by several strands of strong, finely twisted woolen cord. Part of the scalp and hair were still preserved under the bandage. Fragments of the same cloth and cord were available, and Mr. Griffenhagen was able to make an authentic copy upon the Smithsonian skull fashioned from these materials.

The other exhibits will depict the crude surgical dressings of the pre-Christian era, through the time of Lord Lister down to the present day product.

Sterling Drug Inc. will have spent approximately $50,000,000 by the close of 1954 in postwar capital improvements to help "insure the future of the company and of its employees," declared James Hill, Jr., chairman of the board, at Sterling's eighth annual combined meeting of standing committees. Mr. Hill reviewed the organization's physical expansion since 1946, both in this country and overseas, before a gathering of officers and members of the marketing, finance, purchasing, pharmaceutical, control and plant managers' committees. The $50,000,000 capital outlay during the 1946 to 1954 period was allocated for land, buildings, machinery and equipment, Mr. Hill said. Of the total sum, he added, approximately 75 per cent was invested in expanding Sterling's physical facilities in the United States.

SEVERAL groups report good response in the treatment of postmastectomy edemas by use of the Vaso-Pneumatic machine. Other indications allowed by the A.M.A. of particular interest to the surgeon are: acute arterial obstruction, pre- and postsympathectomy, postoperative rehabilitation and athletic and industrial injuries. The apparatus consists of fourteen hollow cuffs that are clipped to the upper or lower extremity. These cuffs are inflated and deflated seriatim so as to mimic a peristaltic pressure wave, or milking action, passing the length of the extremity in either the distal or proximal direction.

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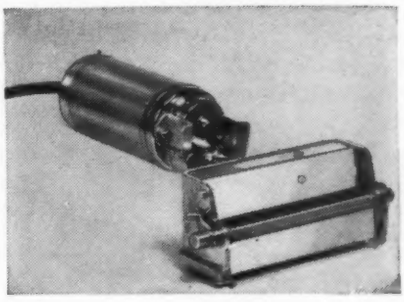

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Hospitals have been taking an increasingly important part in meeting the medical needs of the American people. In 1953 nearly 20,000,000 patients were admitted to the 6,840 hospitals in the United States registered by the American Medical Association: this is two and three-fourths times the number of admissions twenty years ago. Population growth has been a relatively minor factor in this increase, the annual admissions per 1,000 rising from 57 to 126 between 1934 and 1953. Major factors in the growing use of hospitals have been the greater number of beds available and the decrease in the average length of stay per patient. The hospitalization of births has increased markedly in the past two decades, according to reports by the National Office of Vital Statistics. At present about nine of every ten babies are born in hospitals, compared with less than four of every ten about twenty years ago. In large areas of the country, particularly in the Northeast and the Far West, the proportion now exceeds 98 per cent.

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The American Urological Association offers an annual award of $1,000 (first prize of $500, second prize $300 and third prize $200) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been graduated not more than ten years, and to men in training to become urologists. The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association to be held at the Biltmore Hotel, Los Angeles, California, May 16 to 19, 1955. For full particulars write the Executive Secretary, William P. Didusch, 1120 North Charles Street, Baltimore, Maryland. Essays must be in his hands before January 1, 1955.

Detergent fruits are nature's toothbrushes states "Diet and Dental Health," the new booklet published by the American Dental Association.

Mentioned as outstanding among these detergent foods are fruits, such as oranges, grapefruit and apples, and raw vegetables, such as celery and carrots. The booklet advises: "Foods that require thorough mastication, during which they literally sweep over the teeth, between the teeth and over all the soft tissues, cleansing them and stimulating them are called detergent foods. . . . In addition to toothbrushing, every person should include in his diet, particularly at the end of each meal, some detergent food such as a citrus fruit."

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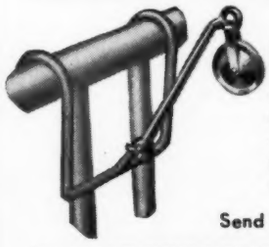

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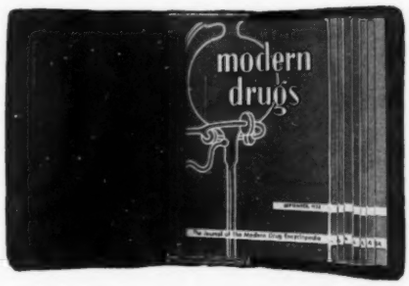

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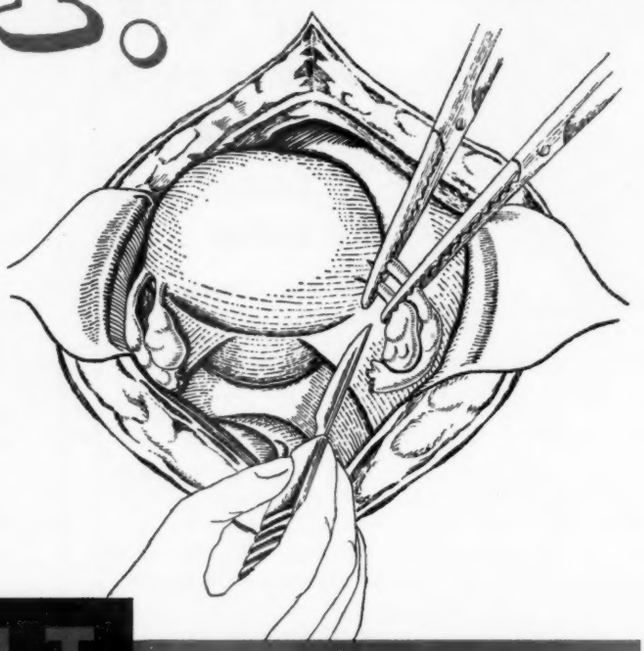

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